APPLYING AN UNFOLDING MODEL TO THE STAGES AND PROCESSES OF CHANGE

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Abstract

The purpose of this study was to utilize the graded unfolding model (GUM) (Roberts, 1995; Roberts & Laughlin, 1996) to examine the interaction between the stages of change (SOC) and the processes of change (POC) for smoking cessation (SC). Although an abundance of research has examined the transtheoretical model (TTM) and SC, the POC remains one of the least investigated dimensions of the TTM. Only one study has applied an item response theory model, the GUM, to the examination of the SOC and POC (Noel, 1999). This study attempted to replicate and extend the findings of Noel (1999) and provides additional external validity evidence for the SOC and the POC for SC. The TTM posits that people undergoing change will use different processes and strategies as they proceed through the SOC and that each POC appears to reach peak use at different stages. Thus, the POC appear to follow an inverse-U-shaped pattern (Noel, 1999).

Responses to the SOC and 40-item POC for SC were collected from young adults. Analysis of the data using the GGUM (Roberts, 2000) demonstrated the applicability of the GUM and provides additional external validity of the POC for SC. More specifically, six POC were ordered as expected according to results of longitudinal studies. Four POC were found to be out of order, however, this could be due to sample characteristics or reduced validity of items (due to smoking law changes, some items may no longer be valid). Helping Relationships and Stimulus Control appeared together out of order. This finding replicates Noel (1999) and further research is needed to examine the ordering of these POC. The GUM was also found to fit the POC data better than other item response theory models.

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Chapter One

Introduction

Organization of Document

This thesis is separated into five chapters. Chapter One introduces a variety of smoking related illnesses, benefits of smoking cessation, the unfolding model as well as the purpose of the study and the research questions. Chapter Two, includes a review of the current literature includes different methods to measure attitudes and the transtheoretical model. In Chapter Three, the methodology of the research design is detailed and Chapter Four portrays the results of the data analysis. Finally, Chapter Five contains a discussion concerning the results and an explanation of the data analysis.

Background

Since there has been an abundance of research with cumulative models on the stages and processes of change and only one study using an unfolding model, the purpose of this study will be to test the Graded Unfolding Model (GUM) as it applies to the stages and processes of change. The current study is not so much a focus on smoking, but to test the transtheoretical model (TTM) by using the GUM. Smoking is just one of the many behaviors that can be tested in the TTM by the GUM and has been selected because there has only been one study to date that has used this model to test this theory.

In recent years smoking has become less prevalent in Canadian society (Canadian Broadcasting Corporation, 2007a). Over the past few years the Provinces and Territories of Canada have begun to create and pass laws against those who purchase, sell, and consume cigarettes (Canadian Broadcasting Corporation, 2007a). Smoking has been banned from a variety of different venues such as the workplace, restaurants, bars, and

other public places. For example, on January 19th, 2005, the Supreme Court of Canada ruled the provinces could reinstate the "shower curtain law" that called for store owners to keep tobacco products out of sight (Canadian Broadcasting Corporation, 2007a). This meant that establishments that sold cigarettes were no longer able to display cigarettes like other products such as food or drinks. Store owners were required to conceal the cigarettes in some fashion in order to keep them out of the public eye. As of October 2004, in the province of Manitoba, the Non-Smokers' Health Protection Act banned smoking in all public areas, with the exception of group-living facilities and hotel rooms (Canadian Broadcasting Corporation, 2007a). In addition, restaurants and bars were no longer able to maintain smoking sections or glassed-in smoking areas for their customers. As of May 2004, in the Territory of Nunavut, smoking was banned in all enclosed businesses and work sites by the Worker's Compensation Board (Canadian Broadcasting Corporation, 2007a). The ban included drinking establishments, within fifteen metres of schools and three metres of building entrances.

Although Canada is thought to be one of the leaders in the movement of anti-smoking legislation (Canadian Broadcasting Corporation, 2007a), other countries have created similar laws within their borders. For instance on February 7th, 2005, Cuba banned smoking in public places, except for designated smoking sections in restaurants (Canadian Broadcasting Corporation, 2007a). Cuba also banned the sale of cigarettes to children under sixteen and at stores within one-hundred metres of a school (Canadian Broadcasting Corporation, 2007a). Italy also introduced legislation on Jan. 10th, 2005, to ban smoking in public places and in December 2004 The Himalayan kingdom of Bhutan

became the first country in the world to ban tobacco sales and smoking in public places (Canadian Broadcasting Corporation, 2007a).

Smoking Related Illnesses

One of the main reasons behind the new legislation being passed in Canada and across the world is that smoking is responsible for nearly one in five deaths in Canada (Physicians for a Smoke-Free Canada, 2007) and the United States (American Cancer Society, 2007). Each year about 45,000 Canadians (Physicians for a Smoke-Free Canada, 2007) and 440,000 Americans die from illnesses related to cigarette smoking (American Cancer Society, 2007). Cigarettes kill more Canadians and Americans than alcohol, car accidents, suicide, AIDS, homicide, and illegal drugs combined (Physicians for a Smoke-Free Canada, 2007; American Cancer Society, 2007).

According to the American Cancer Society, smoking cigarettes accounts for at least thirty percent of all cancer deaths. Cigarette smoking is a major cause of cancers of the lung, larynx (voice box), oral cavity, throat, esophagus, and bladder. Smoking is also a secondary cause in the advancement of cancer in the pancreas, cervix, kidney, and stomach (Physicians for a Smoke-Free Canada, 2007; American Cancer Society, 2007). Specifically, around ninety percent of lung cancer deaths are caused by smoking. Lung cancer is the number one cause of cancer death among men and women, and is one of the most difficult cancers to treat (American Cancer Society, 2007).

Cancer is not the only disease that causes death in a smoker. Smoking is a cause of heart disease, aneurysms, bronchitis, emphysema, stroke, gum disease, cataracts, bone thinning, hip fractures, and peptic ulcers and it contributes to the severity of pneumonia and asthma (American Cancer Society, 2007). Cigarettes also have negative health

effects on female reproductive systems. A female smoker has a decreased probability of reproducing, and a greater probability of miscarriage, premature birth, stillbirth, infant death, and a baby with a low birth weight (American Cancer Society, 2007). In addition, the secondhand smoke that is exhaled from a smoker into the air from cigarettes has similar damaging health effects on those who are exposed to it (American Cancer Society, 2007).

The Centre for Disease Control and Prevention (n.d.) collected data from 1995 to 1999, and estimated that male smokers lost an average of 13.2 years of life and female smokers lost 14.5 years of life because of smoking. However, not all of the previously mentioned health problems related to smoking cigarettes will result in the loss of life (Centre for Disease Control and Prevention, n.d.). Smoking damages almost every major organ of the body which causes disease and reduces the health of smokers (Centre for Disease Control and Prevention, n.d.). According to the CDC (n.d.), about 8.6 million people were suffering from at least one chronic disease due to smoking and many of these individuals were suffering from more than one condition (Centre for Disease Control and Prevention, n.d.).

Benefits of Smoking Cessation

Most of the diseases that affect a smoker or those around second hand smoke are preventable. If a smoker can quit or if a person exposed to second hand smoke can avoid the exposure they will benefit tremendously. In 1990, the US Surgeon General detailed a variety of benefits to smoking cessation (Office of the US Surgeon General, 1990). The first benefit is that former smokers will live longer than those that continue to smoke. For instance, individuals who quit before fifty years of age have half the risk of dying

within the next fifteen years compared to those that continue to smoke. A second benefit of quitting smoking or avoiding second hand smoke is a reduced the likelihood of suffering from cancer, heart attack, stroke, and lung disease. A third benefit, especially intended for women who quit smoking or avoid second hand smoke before becoming pregnant or during the beginning three to four months, is a reduced chance of having a baby with low birth weight.

How People Change

There are two common ways that individuals can change their behavior. Individuals have demonstrated successful behavior change, such as smoking cessation, with the help of professional treatment (Lambert, Shapiro, & Bergin, 1986) or alone without professional treatment (Marlatt, Baer, Donovan, & Divlahan, 1988). Although studies such as these are helpful in determining the ways in which individuals change their behavior they do nothing to detail how behavior change actually takes place. A variety of theories have been used in an attempt to explain how individuals change their behavior. However, Prochaska and Velicer (1997) claim that no one theory can be held responsible for all behavior change and that a combination from many different theories causes behavior change. This is better known as the TTM model (TTM).

The TTM is based on a number of key constructs that include the stages of change, self efficacy, decisional balance, and the processes of change (Buckworth & Wallace, 2002). In the stages of change, individuals move through a sequence of five stages from precontemplation to maintenance. A linear schema of the stages was discovered in research with smokers trying to quit in treatment and on their own (DiClemente & Prochaska, 1982). Individuals were seen as progressing through the

stages of change form precontemplation to contemplation, contemplation to preparation, preparation to action, and action to maintenance. Numerous research studies demonstrate support for the stages of change as a construct (Prochaska & DiClemente, 1992) and have been found in treatment conditions as well as in self changers (DiClemente, Prochaska, & Gilbertini, 1985; McConnaughy, DiClemente, Prochaska, & Velicer, 1989).

Self efficacy, one of the constructs in the TTM model, has also been demonstrated as an important factor (DiClemente, 1981). It represents the individual's belief in their own ability to be able to change their behavior or resist a problem behavior (smoking) across a number of situations. In an exploratory study, a 31 item self efficacy test was able to distinguish participants across the stages of change, with self efficacy increasing from precontemplation to contemplation to action and into maintenance (DiClementre et al., 1985).

When an individual wants to change their behavior, they take into account the pros and cons of changing their behavior; which is a key characteristic of decisional balance in the TTM model. Velicer and colleagues (1985) found that decisional balance could be paired with the stages of change in the decision of health related behaviors. Only two decisional balance measures, the pros and cons of the behavior in question, are considered to be essential constructs in the TTM (Prochaska et al., 1994).

Although self efficacy and decisional balance have been shown to be key constructs in the TTM model, the two major dimensions of the model are the stages and processes of change. The ten processes of change were first identified by Prochaska (1979) by integrating various theories in the TTM model. The processes of change include conscious-raising, self-reevaluation, self-liberation, counterconditioning, stimulus

control, reinforcement management, helping relationships, dramatic relief, environmental reevaluation, and social liberation. The ten processes of change are measured by a 40 item questionnaire that provides a good statistical measure of validity and reliability (Prochaska, Velicer, DiClemente, & Fava, 1988). Each of the processes are measured by four separate items that calculate what processes an individual uses in their attempt to cease or acquire a behavior. The processes of change have been conducted using a number of formats, samples, and yet have demonstrated similar patterns (Prochaska & DiClemente, 1983; Prochaska et al., 1988). The processes demonstrate similar patterns of how individuals change in problem areas such as smoking, psychological distress, and obesity (Prochaska & DiClemente, 1985). The reason the stages and process of change are the most important constructs in the TTM is because they can be integrated together (DiClemente et al., 1991; Prochaska & DiClemente, 1983, 1984). Through this research, investigators are able to identify the processes of change which are emphasized during each stage of change. Being able to identify what stage a person is in allows investigators to predict what processes they are using in order to quit a problem behavior. Additionally, researchers would be able to assist those in treatment programs by identifying what stage and processes they are using in order to help them stop performing a behavior.

Measuring Attitudes and Change

There are a number of different ways that a researcher could measure participant's responses to the stages and processes of change questionnaires. The earliest measurement scales date back to Likert (1932) and Thurstone (1928). The Likert approach can find participants' attitudes towards an object. When constructing a Likert

scale, a great number of preliminary items are developed so that each item expresses either a negative or positive opinion while avoiding neutral items (Roberts, Laughlin, & Wedell, 1999). Participants then indicate their level of agreement towards a statement. This means that an individual will support an item to the extent that the individual is located above the item on the underlying continuum (Roberts et al., 1999), which is essentially examined by a cumulative model. The Thurstone method is thought to be more of an unfolding model. In the Thurstone approach, attitude statements are created by a group of judges in order to cover all possible views about an object and then participants are asked to divulge which statement they agree with. This means that positive, negative and neutral attitudes are included in the Thurstone scale. When selecting an answer to an item in the Thurstone approach, individuals endorse an attitude item to the extent that it reflects the individual's own opinion (Roberts et al., 1999).

There are two features that suggest why the Likert procedure for attitude measurement is used more frequently (Petty & Cacioppo, 1981). Researchers have found that Likert attitude scores demonstrate higher reliability (parallel forms or split half) and higher test-retest reliability as compared to Thurstone attitude scores (Seiler & Hough, 1970). The Likert procedure is easier and less time consuming (more efficient) to conduct for researchers than the Thurstone technique, mainly because the Likert procedure does not require a judgment group to produce item scale values (Mueller, 1986). However, the Likert procedure only measures items that are positive or negative and disregards any items that represent a neutral attitude. If a scale only identifies positive and negative attitude items then an individual who holds a neutral attitude won't have their attitude properly represented in a Likert procedure. The advantage of the

Thurstone technique is that when judges are creating the statements for the scale they can incorporate all possible attitudes that individuals might hold. As a result, using a Thurstone type approach (unfolding model), instruments are able to measure those with many different attitudes rather than just positive or negative opinions.

A relatively new unfolding model, called the GUM was developed to measure attitude statements (Roberts & Laughlin, 1996). The GUM is an unfolding item response theory (IRT) model that is used for graded disagree-agree rating scale responses (Roberts & Laughlin, 1996). The GUM is based on four principles that describe they way that it measures attitudes: (1) When participants respond to a graded disagree-agree item they tend to agree with the item to the extent that it is located near their own attitude; (2) there are always two subjective responses associated with each observable response on the rating scale; (3) subjective responses to attitude items follow a cumulative item response model, and (4) the model is characterized in terms of the observable response categories that are associated with the graded disagree-agree scale (Roberts & Laughlin, 1996).

Unfolding Model Applied to Smoking Cessation

Previous research has shown that the stages of change include different processes of change (Prochaska et al., 1991). Until recently, an unfolding model had never been used to support the theory that there are stages within the process of quitting smoking. Only one study has explained the processes of change using the GUM (Noel, 1999). In this study, data was collected from participants in France that were involved in a treatment program. Results suggested for that items designed to measure each process of change were, to a large extent, in the order predicted by the original theory (Prochaska et

al., 1988). The participants who scored higher in the change process were identified as the ones who were most likely to quit smoking (Noel, 1999).

One argument that Noel (1999) demonstrated in the study was that the processes of change are unfolding. This means that once a person moves from one stage to another, they do not use the processes of change associated with the previous stage. It has been demonstrated that the processes are curvilinear (Prochaska et al., 1991) and that certain processes occur during certain stages of change. Thus, if one pattern in the process of change is selected and put into the unfolding model for analysis, it may only be prevalent only at one stage. For example the processes statement: *my dependency on cigarettes make me feel disappointed* can be rejected at different stages of change for two reasons: (1) because the smoker does not consider smoking as serious a problem; and (2) he or she has gained control over the addiction and has fewer reasons to feel disappointed (Noel, 1999). Only when an individual enters a certain stage will this process be found. For instance, the first reason a processes statement will not be found in an individual who is in precontemplation is because he or she does not believe there is anything wrong with their current behavior. Conversely, the second reason a processes statement will not be found in individuals who are in the maintenance stage is because he or she is no longer affected by the problem behavior. It is unlikely that smokers are aware that they disagree with this processes item because they have not reached the stage of change that would make this attitude available (Noel, 1999).

There were some limitations to the work conducted by Noel (1999). Some of the processes of change were found to be between different stages instead of showing up in a certain stage. For example, one process of change, environmental reevaluation, which in

Prochaska et al. (1991) was found at the end of the contemplation stage, was located one stage of change later in the Noel (1999) study. This could be because the results were obtained from a single measure on the clinical sample used by Noel (1999) or because of cultural differences since the questionnaire was created for North American participants and the sample was from France. Cultural differences might also have influenced some of the results. Noel (1999) found that 13 of the 40 items of the questionnaire demonstrated poor fit to the model. For example, social liberation and counterconditioning were poorly represented. According to Noel (1999), some cultural distinctiveness might have influenced this finding because only recently has there been social pressure against smoking in France as compared to North America.

Another limitation of the Noel (1999) study was the small sample size. There were only 140 French smokers in the study. In other studies measuring the stages and processes of change, the sample sizes were much larger. For instance, in Prochaska et al. (1988), there were 970 participants and in Prochaska et al. (1991) there were 544 participants. An increase in the sample size might have allowed Noel (1999) to find the processes in the stages that have been demonstrated in previous research (Prochaska et al., 1991) instead of having some processes in between or at different stages. In addition to the small sample size, all participants in the Noel (1999) study were smokers. By including participants with some other type of smoking experience, the sample would have been more representative across the stages. This could have yielded much different results when looking at the processes in the stages of change. A further problem with the sample is that the participants were recruited in a clinical context (Noel, 1999). This makes it unlikely that participants were able to express attitudes that were more

characteristic of earlier stages of change and were unlikely to engage in behaviors characteristic of recent quitters (Noel, 1999).

Research Questions

This study used the Noel (1999) study as a template with a sample of young Canadian adults with various smoking experience. The first research question included in this study will be: Can the GUM account for a relationship between the stages and processes of change? Since it has been found that a cumulative model can account for an interaction between the stages and processes of change and that Noel (1999) has also found this interaction using an unfolding model, this study attempted to find an interaction between the stages and processes of change using the GUM. Another area that was investigated was the actual processes in the processes of change. Noel (1999) found that individuals that belonged to certain stages of change used specific processes of change, which were represented by a curvilinear pattern. In other words, once an individual moves from one stage to another, they do not use the processes of change associated with that earlier stage any longer. Thus, the second research question that was investigated was: Can the GUM account for the curvilinear pattern in the processes of change? The third research question addressed in this study was: Will using the GUM and applying it to the stages and processes of change for smoking on a North American sample yield similar results as demonstrated by Noel (1999)? This study will tried to replicate the results that were found by Noel (1999) using the GUM.

Measuring the relationship between the stages and processes of change using an unfolding model, will provide further support to the TTM if similar results as the cumulative model identified by Prochaska et al. (1991) are found because the model is

able to fit different scales of attitude measurement. The replicating this study is the first time that the unfolding model will be used based on the integration of the stages and processes of change on a North American sample. By identifying the interaction between the stages and processes of change using the unfolding model this study will demonstrate support for the results obtained by Noel (1999). One advantage to using an unfolding model is that it measures all the different types of attitudes that various individuals hold as opposed to the cumulative model. When measuring attitudes with a cumulative model there are specific scale positions (strongly disagree, disagree, agree, strongly agree); whereas the unfolding model can measure attitudes that are neutral. In addition, demonstrating the integration of the stages and processes of change can assist those who are in a position to create efficient intervention strategies for individuals at different stages of change who want help quitting smoking.

This chapter has given an introduction to the unfolding model, the purpose of the study, and the research questions that will be addressed. Chapter Two will investigate a review of the current literature on attitudes measurement scales and the transtheoretical model.

Definitions

Below is a list of definitions that will be used throughout this study.

Cumulative Model - the greater the location of a person relative to the location of an item on a continuum, the greater the probability of a positive response (Andrich & Lou, 1993).

Decisional Balance - Balance refers to the perception of benefits and costs (pros and cons) of the target behavior, which are believed to influence decisions and behavior (Buckworth & Wallace, 2002).

Dominance Response Process - an individual agrees with a positively worded attitude statement to the extent that the own individual's opinion is more positive than the attitude expressed in the statement (Coombs, 1964; Roberts & Laughlin, 1996).

Ideal Point Process - a person agrees with an attitude item to the degree that the item characterizes the individual's opinion (Coombs, 1964).

Process of Change - refers to overt and covert strategies used to change behavior (Buckworth & Wallace, 2002).

Self Efficacy - efficacy refers to the situation specific confidence to engage in any type of

behavior with known outcomes (Buckworth & Wallace, 2002).

Stages of Change - describes change based on an individual's past behavior and any plans for future action. There are five stages of change which include precontemplation, contemplation, preparation, action, and maintenance (Buckworth & Wallace, 2002).

TTM (Transtheoretical Model) – developed based on a comparative analysis of leading theories of psychoanalysis and behavior change. Critical contribution is the inclusion of temporal dimension than integrates concepts from different theoretical perspectives. Core constructs include the stages of change, self efficacy, decisional balance, and the processes of change (Buckworth & Wallace, 2002).

Unfolding Model - the closer the location of the person to the location of the item, no matter the direction, the greater the probability of a positive response (Andrich & Lou, 1993).

Chapter Two

Review of the Literature

This chapter will inspect the current literature with respect to attitude measurement and the transtheoretical model. First, risks and preventative measures in cigarette smoking will be outlined. The second section will include a review of the different approaches to attitude measurement including the Likert Approach, Thurstone Approach, and the Graded Unfolding Model. In the third section, the core components of the transtheoretical model are detailed. These components include the stages of change, self efficacy, decisional balance, and the processes of change. Finally, empirical findings of the transtheoretical model and Noel's (1999) unfolding analysis of smoking cessation are presented.

Risks and Preventative Measures in Cigarette Smoking

When an individual chooses to smoke they are putting themselves at severe risk for a number of diseases and ailments. Those who smoke cigarettes regularly are in danger of many different forms of cancer, heart diseases, and lung diseases which are largely preventable if one chooses to quit or not to smoke (Physicians for a Smoke-Free Canada, 2007; American Cancer Society, 1998). These types of diseases are attributed to the more than 45,000 Canadians (Physicians for a Smoke-Free Canada, 2007) and 400,000 Americans who lose their lives each year (American Cancer Society, 2007). There is also an increase the financial burden of governments and taxpayers to pay for medical expenses for those that become ill from smoking cigarettes. Smoking cigarettes in Canada cost $2.5 billion in smoking attributable health care (Kaiserman, 1991). Additionally, smoking-attributable costs included $1.5 billion for residential care, $2

billion due to workers' absenteeism, $80 million due to fires and $10.5 billion due to lost future income caused by premature death (Kaiserman, 1991). Smoking cigarettes in the USA drained more than $100 billion in health care costs in 1996, doubling from $50 million in 1993 (American Cancer Society, 1998). Of these costs, approximately 43% were paid for through government funds (American Cancer Society, 1998). Over the course of their lives smokers and former smokers create an estimated $501 billion in excess health care costs (American Cancer Society, 1998).

Alarming numbers such as these have changed the attitudes that the general public and governments in Canada and around the world have towards cigarette smoking. A series of steps over the years by the Provincial and Federal governments in Canada has brought about much of the change we see today. In May 1998, The Tobacco Sales to Young Persons Act was introduced in Canada that prohibited the sale of any tobacco products to those under the age of eighteen (Canadian Broadcasting Corporation, 2007b). In January 1989, The Tobacco Products Control Act (Bill C-51) was established which required cigarette manufactures to list the additives and amounts in tobacco (Canadian Broadcasting Corporation, 2007b). In 1994, the Federal government passed legislation that carry warning messages on cigarette packages such as “smoking can kill you”, “cigarettes cause cancer”, and “cigarettes are addictive” (Canadian Broadcasting Corporation, 2007b). In addition, in 2000, legislation was passed that required all cigarette packages to carry one of sixteen health warnings that must cover half of the package and include graphic images such as cancerous lungs and diseased mouths (Canadian Broadcasting Corporation, 2007b). The change in legislation brought about by the Federal government acted as a template for the Provincial governments to begin to

create policies of their own with respect to cigarette smoking. In Canada, as of 2006, every province and territory has some type of ban against smoking in bars, bingo halls, restaurants, workplaces, casinos, hospitals, and many other public places (Canadian Broadcasting Corporation, 2007a).

The Likert Approach

When researchers want to measure attitudes towards a construct, two methods are used. The first method, known as the Thurstone scale, was created by Thurstone (1928). The second method, known as the Likert Scale, was created by Likert (1932). Both of these scaling methods are thought to provide similar attitude validity scores (Mueller, 1986). In spite of this, the Likert approach to measuring attitudes is more frequently used as it is thought to be more capable to put into practice than the Thurstone approach (Petty & Cacioppo, 1981).

Constructing a Likert scale includes the composition of a large collection of positive and negative items. Participants are asked to indicate their agreement with each item by choosing an option that closely describes their position using a graded disagree-agree scale (Roberts et al., 1999). Choosing items for the final scale is restricted to a relatively small set of items that are indicative of discrimination, homogeneity, and high reliability (Roberts et al., 1999). After the items for the final scale have been selected, the negatively worded items are then reversed for scoring and the values of each item are added up to present a total scale score for each participant. The Likert scale procedure attempts to measure participant attitudes without obtaining the location of attitude items on the underlying continuum. This means that the scale is developed without deriving item scale values (Roberts et al., 1999).

The procedure that is used to select final scale items are in uniform with the idea of a dominance response process (Coombs, 1964). During the dominance response process, an individual supports an item to the extent that the individual is located above the item on the underlying continuum (Roberts et al., 1999). The response from a dominance response process is usually examined with a form of cumulative model where the likelihood of endorsement increases as the distance between the individual and the item on the continuum increases. Many different researchers have noted that the Likert procedure is a type of cumulative model (Andrich, 1996; Roberts, 1995). In addition, individuals are anticipated to agree with a positively worded item to the extent that their attitudes are more positive or dominant than the stated item (Roberts et al., 1999). On the other hand, individuals are expected to support a negatively worded item to the extent that their attitudes are much more negative than the judgment put forth by the item.

The Likert approach measures attitudes based on a disagree-agree response system. For example a participant can be asked to rate their agreement with a question. A Likert scale question can look like this:

Water is good to put in cereal

Strongly Disagree	Disagree	Agree	Strongly Agree.
1	2	3	4

The Thurstone Approach

Thurstone was the first to demonstrate that attitudes can be measured (Roberts et al., 1999). Thurstone's work in this field generated an abundance of work on the measurement of attitudes and other social constructs found in the social sciences. According to researchers, the Thurstone approach is an unfolding model (Andrich, 1996; Roberts, 1995; Roberts et al., 1999). The Thurstone approach to attitude scale

development involves two key stages. In the first stage, a variety of attitudinal statements are created in order to cover the entire distribution of opinions that individuals may hold. This means that positive, negative, and neutral attitude items are created. A small example of attitude statements in the Thrustone approach that attempt to cover the entire range of possible opinions might look like this:

Abortion is acceptable
Abortion is not acceptable
Abortion is okay in certain circumstances

These items are then scaled with regard to their unfavorability or favorability toward an attitude concept (Roberts et al., 1999). There are several Thurstonian procedures for scaling attitude items which include pairwise comparisons (Thurstone, 1927a; 1927b, 1927c), equal-appearing intervals (Thurstone & Chave, 1929), and successive intervals (Safir, 1937). All of these methods require a group of participants or judges to make statements of favorability about each item individually or each pair of items. All three of the methods find a set of item scale values that specify how favorably or unfavorably the item's response reflects the attitude construct. The items with high standard errors are rejected and the final scale is restricted to applicable items with scale values that are uniformly distributed across the attitude continuum (Roberts et al., 1999).

In the second stage, participants or judges are asked to reveal which of the attitude statements they agree with. Participants are encouraged to rank items in numbered order starting with the first statement that they agree with the most. This is followed by the statement that they agree with, but with less favorability than the first statement. This occurs until all the statements have been put into descending order. For example, a participant might put them in this order:

1. Abortion is not acceptable
2. Abortion is okay in certain circumstances
3. Abortion is acceptable

Attitude estimates are then developed for each individual by finding the mean (or the median) scale value associated with the supported items (Roberts et al., 1999). The final Thurstone scale is restricted to relevant items with scale values that are again uniformly distributed across the attitude continuum. An item is considered relevant when it draws support predominantly from participants or judges whose attitudes are comparable to the sentiment communicated by the item (Roberts et al., 1999).

The Graded Unfolding Model

The two main response processes for creating psychological variables are the cumulative process and the unfolding process (Andrich & Lou, 1993). In the cumulative model, the greater the location of a person relative to the location of an item on a continuum, the greater the probability of a positive response (Andrich & Lou, 1993). For example, individuals are expected to agree with a positively worded item to the degree that their attitude is more positive than the attitude expressed by the item (Roberts et al., 1999). This means that if a person has a strong belief in the need for capital punishment for a crime and the item is in favor of capital punishment then their attitude will be very positive. On the other hand, individuals are expected to support a negatively worded item to the degree that their attitudes are more negative than the attitude expressed by the item (Roberts et al., 1999). For example, if a person has a strong belief against capital punishment and the item does not support capital punishment, then their attitude will be very negative.

In the unfolding model, the closer the location of the person to the location of the item, no matter the direction, the greater the probability of a positive response (Andrich & Lou, 1993). To describe the unfolding response process, consider a dichotomous response of agree or disagree when a person encounters a statement in which the person and the statement are located on the same linear continuum (Andrich & Lou, 1993). The statement *I don't believe in capital punishment but I am not sure it isn't necessary* can be considered to reflect an ambiguous attitude item toward capital punishment. If the individual's location is very close to the statement location, (ambivalent or moderate about capital punishment), the person will tend to agree with the statement (Andrich & Lou, 1993). As the person's location increases in distance from the statement in either direction (for or against capital punishment) the probability of the person selecting Agree will decrease (Andrich & Lou, 1993). This gives the single peaked form of the probability of the Agree response, which is the curve that is focused on. When looking at the Disagree response, the probability of a Disagree response will increase as the individual's location becomes greater than that of the statement (in favor of capital punishment) and as the individual's location becomes much less than the location of the statement (against capital punishment) (Anrich & Lou, 1993). Therefore, an individual can choose the Disagree response for two different reasons.

A Disagree response gives no indication of the direction in which the person is distant from the statement; this gave rise to the term "unfolding" (Coombs, 1950). According to Andrich and Lou (1993) the continuum has both directions aligned with each other at the location of the person (persons' ideal point) and it needs to be unfolded in order to establish a continuum. When considering keeping the two reasons for the

Disagree response distinct, the following three latent responses results in the manifest response of Agree and Disagree: (1) disagree because the person considers themselves below the location of the statement, (2) agree because the person considered themselves close to the location of the statement, and (3) disagree because the person considers themselves above the location of the statement (Andrich & Lou, 1993). Consider the statement *I don't believe in capital punishment but I am not sure it isn't necessary.* An individual may disagree with this statement because it does not fully meet their own attitude. This means that the person does not believe that their attitude is captured by this statement, so they will disagree from below because their attitude is weaker than the statement or disagree from above because their attitude is stronger than the statement. An individual can agree with this statement because this is what they feel reflects their attitude. The probabilities of disagree-below and disagree-above have a decreasing and increasing structure making the two reasons for a Disagree response explicit and relevant to the unfolding process (Andrich & Lou, 1993).

In addition to the cumulative and unfolding response model processes, there are two important data collection objectives. In the single stimulus response design, an individual will reply directly to an item or statement by responding either correctly or incorrectly, or by agreeing or disagreeing with it. In the pair-comparison design, the individual either compares two items or statements for their location on a continuum or selects one of two statements. The item or statement that the individual chooses best represents his or her attitude location.

Using disagree-agree response for measuring individual's attitudes has long been a part of the social sciences. The thought of measuring attitudes can be traced back to

Thurstone (1928) and Likert (1932) who both developed scales to measure attitude items. The Thurstone approach to attitude measurement allows an individual to provide disagree-agree responses to a set of attitude statements and then the responses to the statements allow for the development of an estimate of each individual's attitude (Roberts & Laughlin, 1996). The Likert approach to measuring individual's attitudes used a graded agreement scale (strongly disagree, disagree, agree, strongly agree) and the graded response are used to find an attitude score toward an item or set of statements. Methods used to analyze disagree-agree responses (binary/Thurstone or graded/Likert) to attitude items usually follow one of two ideas about the response process (Roberts & Laughlin, 1996). The first perception suggests that disagree-agree responses come from an ideal point process (Coombs, 1964) where a person agrees with an attitude item to the degree that the item characterizes the individual's opinion. The Thurstone approach is considered an example of an ideal point process since individuals are thought to have attitudes that are closely related to the one's that they choose to support during testing. The second perception suggest that disagree-agree responses are the result of a dominance process (Coombs, 1964) where an individual agrees with a positively worded attitude statement to the extent that the own individual's opinion is more positive than the attitude expressed in the statement (Roberts & Laughlin, 1996). The same idea occurs when an individual agrees with a negatively worded statement to the extent that the individual's opinion is more negative than the attitude declared by the statement.

According to this perspective, disagree-agree responses are best analyzed using some type of cumulative model (Roberts & Laughlin, 1996). However several researchers have disputed that disagree-agree responses are more consistent with the ideal

point perspective (Roberts, 1995; Roberts, Laughlin, & Wedell, 1996). This means that attitude measures based on disagree-agree responses are more appropriately developed from unfolding models than from cumulative models (Roberts & Laughlin, 1996). Roberts (1995) also demonstrated that cumulative models can find attitude measures that are nonmonotonically related to the latent trait when such models are applied to responses from an ideal point process.

Although unfolding models appear most appropriate for disagree-agree data, applying the unfolding item response models to attitudes remains problematic because such models allow only for binary disagree-agree responses (Roberts & Laughlin, 1996). To remedy this problem Roberts and Laughlin (1996) proposed an unfolding item response model for disagree-agree responses that result from either binary or graded scales. The new model is an extension of Andrich and Lou's (1993) model for binary data. This new model is called the GUM and it includes a single peaked response function that is applicable in situations where responses are generated from an ideal point process (Roberts & Laughlin, 1996).

According to Roberts & Laughlin (1996) the GUM is based on four key principles. The first is that when participants respond to a graded disagree-agree item they tend to agree with the item to the extent that it is located near their own opinion on the attitude continuum. The degree to which the statement of an item closely resembled the opinion of an individual is given by the proximity of the person to the item on the attitude continuum. The second principle is that there are always two subjective responses associated with each observable response on the rating scale (Roberts & Laughlin, 1996). For instance, a participant with a neutral attitude may strongly disagree

with a very polar item with an item that describes the practice of capital punishment. This individual may strongly disagree with an item that describes the practice of capital punishment in either a very negative or very positive manner. If the content of the item is more negative than the participant's attitude then the participant will strongly disagree from above the item. On the other hand, if the content of the item is more positive than the participant's attitude then the participant will strongly disagree from below the item (Roberts & Laughlin, 1996).

The third principle deals with subjective responses to the attitude items follows a cumulative item response model (Roberts & Laughlin, 1996). Figure 1 demonstrates the graded unfolding model for a hypothetical item with four response categories (strongly disagree, disagree, agree, and strongly agree). The horizontal axis symbolizes the attitude continuum and is scaled in terms of distance between the participant's attitude and the location of the item (Roberts & Laughlin, 1996). Since participants may answer any of the four response categories because their attitude is positioned either above or below the item location, eight subjective separate response categories and probability functions occur (Roberts & Laughlin, 1996). The vertical axis stands for the probability that a participant's subjective response will fall into one of the subjective response categories. Thus, there are seven lines separating each subjective response category and the most probably subjective response within each interval is labeled below. For example consider a subjective attitude towards capital punishment statement: *I don't believe in capital punishment but I am not sure it isn't necessary*. If the individual's location is close to the statement location (ambivalent), the person will tend to agree with this statement (Andrich & Lou, 1993). So, as the individual's location increases in distance from the

statement in either direction (for or against capital punishment), the probability of the person selecting Agree will decrease (Andrich & Lou, 1993). The probability of a Disagree response will increase as the individual's location becomes greater than that of the statement, very much in favor of capital punishment, and as the individual's location becomes less than the location of the statement (Andirch & Lou, 1993). Therefore, three responses can result from Agreeing or Disagreeing: disagree because the individual considers him/herself to be below the location of the statement – disagree below, agree because the individual considers him/herself close to the location of the statement – agree close, and disagree because the individual considers him/herself above the location of the statement – disagree above (Andrich & Lou, 1993).

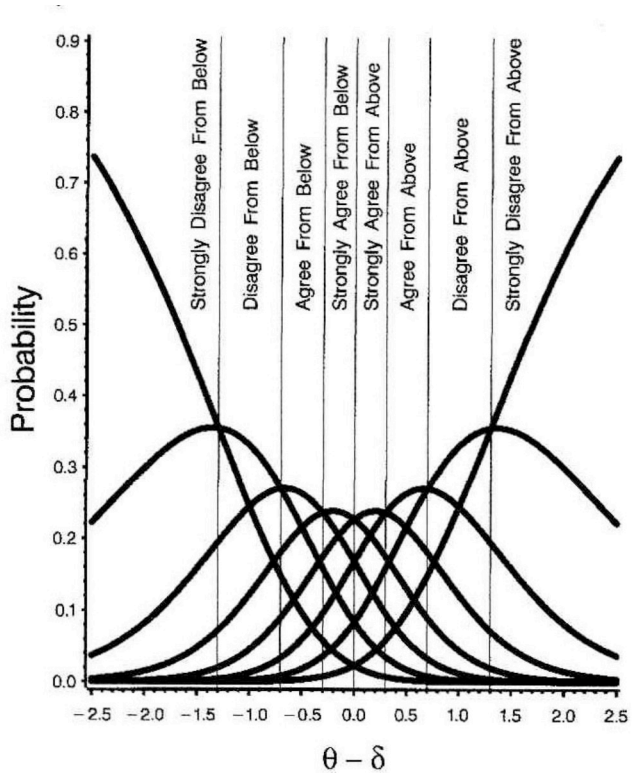

Figure 1. Observable Response Category Probability Function for a Hypothetical Four Category Item (Roberts & Laughlin, 1996).

The fourth principle is that the model is characterized in terms of the observable response categories that are associated with the graded disagree-agree scale. Figure 2 demonstrates response categories probability functions for the same items as Figure 1 (Roberts & Laughlin, 1996). One probability function is affiliated with each response option and by summing the two corresponding subjective response category probability functions shown in Figure 1. From this, each of the observable response category probability functions can be created (Roberts & Laughlin, 1996).

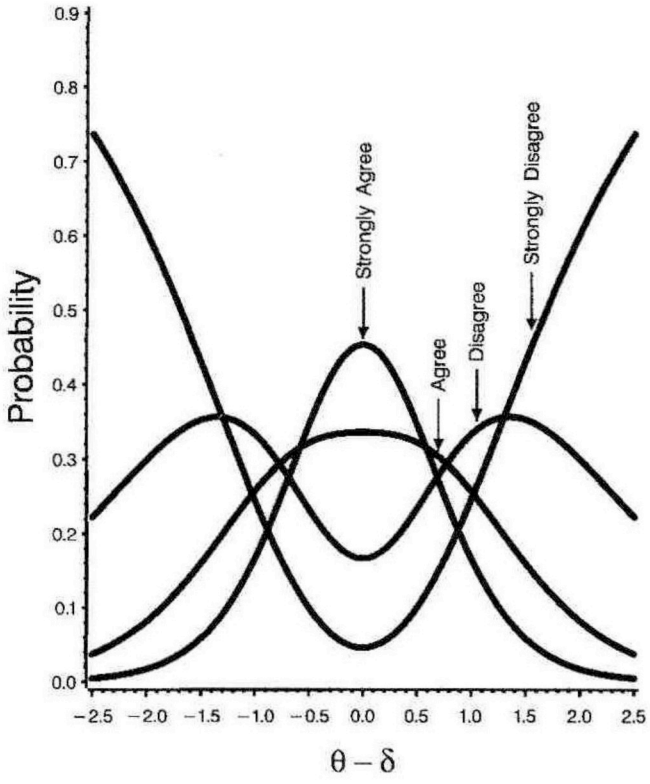

Figure 2. Observable Response Categories associated with graded disagree-agree scales (Roberts & Laughlin, 1996).

Accurate estimates of GUM parameters are obtained with as few as 15 six category attitude items and a sample size of 100 (Roberts & Laughlin, 1996).

Additionally the unfolding model is considered appropriate for measuring a vast amount of different constructs which include individual attitudes using data from either the Thurstone or Likert attitude questionnaires (Andrich, 1996; Roberts, 1995; Roberts et al., 1999).

The Transtheoretical Model

The TTM was developed based on a comparative analysis of different theories of psychology and behavior change. Researchers have outlined a few critical assumptions of the TTM (Prochaska & Velicer, 1997). One assumption is that not one single theory can be held accountable for all the complexities of behavior change that is observable. By integrating multiple theories of behavior change, a more complete model emerged. A second assumption is that behavior change is a process and it takes time to progress through a series of stages (Prochaska & Velicer, 1997). Behavior change does not happen overnight, especially for problem behaviors. It takes a large amount of time and effort for an individual to change a behavior that they have been accustomed to performing for a long period of time. There is a risk involved with changing since it is ultimately changing a part of who you are. An individual might have to change part of their lives such as their social and personal lives. Another factor that requires behavior change to occur over long periods of time is the risk of a relapse (Prochaska & Velicer, 1997). An individual can change their behavior for a short period of time but might relapse and go back to performing the problem behavior. It takes a long time to change the behavior because of these different risk factors.

Without any planned intervention done by the individual, an individual will remain stuck in the early stages of behavior change (Prochaska & Velicer, 1997). If an

individual does not have a plan to change their behavior, then there will be no motivation to change. However, if a person is motivated to change their behavior then there are specific processes and principles of change that can be applied during certain stages of change if progress through the stages is to occur (Prochaska & Velicer, 1997). These processes and principles are what Buckworth and Wallace (2002) call the core construct of the TTM. The core constructs are the stages of change, self efficacy, decisional balance, and the process of change (Buckworth & Wallace, 2002). The TTM has been presented as an integrative and comprehensive model of behavior change (Prochaska & DiClemente, 1983). Research has provided strong support for the reliability and validity of the core constructs in the TTM such as the stages and processes of change (McConnaughy et al., 1989).

The Stages of Change

The stages of change are the most commonly used construct in the TTM model. It describes change based on an individual's past behavior and any plans for future action. There are five stages of change which include precontemplation, contemplation, preparation, action, and maintenance (Buckworth & Wallace, 2002).

Precontemplation is a period in which smokers (or other behavior changers) are not thinking about quitting, particularly within the next six months (Prochaska et al., 1994). Individuals in the stage do not consider changing and see no reason to change their behavior. They may also not see their behavior as problematic.

Contemplation is the period of time in which smokers (or other behavior changers) are seriously thinking about quitting smoking in the next six months (Prochaska et al., 1994). Here individuals are unsure about change. They must consider

giving up or taking on a new behavior. The benefits (pros) and losses (cons) of changing the undesirable behavior are considered during contemplation.

Preparation is the time in which smokers (or other behavior changers) who have tried to quit smoking in the past year or are seriously think about quitting smoking in the next month (Prochaska et al., 1994). Individuals prepare to make specific behavior changes. The individual might experiment with small changes as they become more determined to change their behavior.

Action is a period of time ranging from zero to six months after smokers (or other behavior changers) have made the overt change of stopping smoking (Prochaska et al., 1994). Originally this stage was separated into a zero to three month early action period and three to six month later action period. However no differences were found between early and later action in terms of frequency of use of change processes used to quit smoking (Prochaska et al., 1994). This period is considered the busiest period of change by Prochaska and DiClemente (1983).

Maintenance is defined as the period beginning six months after the action stage has started and it continues until smoking (or other behavior) is terminated (Prochaska et al., 1994). Individuals in the maintenance stage do what they can to prevent a relapse from occurring. This stage can be considered to last a lifetime.

Self Efficacy

Self efficacy refers to the situation specific confidence to engage in any type of behavior (Buckworth & Wallace, 2002). Self efficacy represents the individual's level of confidence that they have to be able to resist a problem behavior across a number of tempting situations. This is based on Bandura's (1977, 1982) research demonstrating the

importance of self efficacy for behavior change. In a preliminary study, a measure of self efficacy was found to be able to predict which self changers and therapy changers would maintain their nonsmoking five to seven months after quitting (DiClemente, 1981). The measure was found to discriminate across the stages of change in smoking behavior. The participants in the study were found to have gains in self efficacy that increase from precontemplation to contemplation to action and into maintenance (DiClemente et al., 1985).

Decisional Balance

Decisional Balance refers to the perception the benefits and costs (pros and cons) of the target behavior, which are believed to influence decisions and behavior (Buckworth & Wallace, 2002). The TTM has the ability to integrate core constructs from Janis and Mann's (1977) decision making model. This model is considered a conflict model which assumes that sensible decision making includes thorough examination of all applicable considerations that enter into a decision of potential gains and losses (Mann, 1972). In Janis and Mann's (1977) model it, states that the anticipated gains (benefits) and the anticipated losses (costs) can be grouped into four different types of outcomes or consequences: (a) utilitarian gains or losses the self, (b) utilitarian gains or losses for significant others, (c) approval or disapproval from significant others, and (d) self-approval or self-disapproval.

Velicer et al. (1985) then created a decisional balance measure to investigate the decision making process across that stages of change. The researchers found that decisional balance could be paired with the stages of change in studying the pattern of cognitive and motivational shifts across the stages in the resolution of health related and

personal problems. Only two decisional balance measures, the pros and cons of the behavior in question, are considered to be essential constructs in the TTM (Prochaska et al., 1994). However the balance between the pros and cons fluctuates depending on which of the stages of change an individual is in. In the precontemplation stage, individuals will claim the pros of the problem behavior to outweigh the cons. In the action and maintenance stage the cons will outweigh the pros. The pros and cons of a problem behavior cross over in the contemplation and preparation stages (Prochaska et al., 1994).

The Processes of Change

Recall that the stages of change represent where there are certain shifts in a particular behavior. The process of change characterizes how the shifts in behavior occur. The processes of change refer to overt and covert strategies used to change behavior (Buckworth & Wallace, 2002). Each process is a broad category including a variety of techniques, methods, and interventions that are generally associated with different theories and therapies (Prochaska, DiClemente, & Norcross, 1992). The processes of change were first identified during a comparative analysis of 18 major therapy systems by Prochaska (1979) where he identified 10 basic processes of change. Prochaska and DiClemente (1984) claim that the basic processes of change can account for how people change their own behavior as well as how they can change while in therapy.

As stated earlier there are ten processes of change (Prochaska, 1979). The processes include conscious-raising, self-reevaluation, self-liberation, counterconditioning, stimulus control, reinforcement management, helping relationships,

dramatic relief, environmental reevaluation, and social liberation. In conscious-raising, increased information about the self and the problem behavior are brought to the attention of the individual with problem behavior (Prochaska et al., 1992). This can be done through personal observations of the behavior or other individuals bringing it to your attention. In this process, an individual's awareness is increased which can assist in thinking about quitting a behavior. In self-reevaluation an individual assesses his/her own thoughts and feelings about him/her with respect to the problem behavior. To increase self-reevaluation an individual might clarify why they would like to cease the problem behavior and imagine what it would be like to be free of it. The concept of self-liberation includes choosing and committing to act or believe in the ability to change. An increase in self-liberation involves weighing the pros and cons of a problem behavior and making a rationale choice.

Counterconditioning consists of substituting alternatives activities in place of the problem behavior. For instance, an individual who is relaxed by taking deep breaths or repeat positive self statements to ensure that they don't become involved in the problem behavior. Stimulus control contains avoiding or countering stimuli that elicit problem behaviors. For example, if a person is a smoker they would try to avoid going to places that allow smoking. Individuals will want to take themselves out of these types of situations so they are not tempted. Reinforcement management is composed of rewarding one's self or rewarded by others for making the necessary changes. An individual can self reward in many different ways. A person can pre-select items that they find rewarding and if they attain the goals that they set for themselves then they will obtain the reward.

Helping relationships consists of being open and trusting with someone who cares. An individual in need of a helping relationship can seek support from others in self-help groups, therapy, and or types of social support groups. In dramatic relief an individual with a problem behavior will experience and express feelings about the problem and the possible solutions that are available. During environmental reevaluation the individual assess how the problem affects their physical environment. The individual is able to see the harm that their problem behavior is causing around them. By seeing the harm that their behavior causes, the individual can feel empathetic to their environment which can lead to behavior change. The final process of change is social liberation. In social liberation there is an increase in alternatives that can replace the problem behavior. The individual can take part in many other behaviors other than the problem behavior.

Perhaps the single most important discovery in behavior change research is the ability to integrate the processes and stages of change (DiClemente et al., 1991). The table presented below demonstrates the integration from cross-sectional research.

Table 1 (Prochaska et al., 1992)

Stages of Change in Which Particular Processes of Change are Emphasized				
Precontemplation	Contemplation	Preparation	Action	Maintenance
Consciousness-Raising Dramatic Relief Environmental Reevaluation				
	Self-reevaluation			
		Self Liberation		
				Reinforcement Management Helping Relationships
			Counterconditioning	
				Stimulus Control

During the precontemplation stage individuals processed less information about their problem behavior, spent less time self-reevaluating, had fewer negative emotional reactions about their problem behavior, did not talk about their problem behavior with others, and did little to try to overcome their problem (Prochaska et al., 1992). Individuals in the contemplation stage were open to conscious raising techniques, dramatic relief experiences, reevaluated him/herself and their environment. Moving through the contemplation stage includes an increase in cognitive, affective, and evaluative processes of change, much of which occurs during the preparation stage (Prochaska et al., 1992). Extending into the action stage an individual will use counterconditioning and stimulus control to reduce their use of smoking cigarettes and to control the situations where they relied on the substance (DiClemente et al., 1991). Throughout the action stage, individuals demonstrate an increase in self liberation and use counterconditioning and stimulus control in order to prevent a relapse (Prochaska et al., 1992). Maintenance builds on each of the processes that come before it (Prochaska et al., 1992). During maintenance an individual would prepare to deal with the conditions under which a relapse would likely occur by using counterconditioning and stimulus control as their main tools.

Empirical Findings of the TTM

In the TTM model, three effects are thought to assist in determining various outcomes that individuals with problem behaviors face. The three effects are treatment effects, severity effects, and stage effects. The assumption behind the treatment effect is that individuals who are receiving treatment for their problem behavior should have better outcomes than those who are not receiving any treatment (Prochaska, Velicer,

Prochaska, & Johnson, 2004). The severity effect assumes that individuals who face more severe consequences for not changing their problem behavior, such as a possible life threatening illness, should change more (Prochaska et al., 2004). The stage effect is thought to be the most influential cause of a healthy behavior change. Stage effects occur when individuals who are in the precontemplation stage take less action over time than those in the contemplation stage, who take less action than those in the preparation stage (Prochaska et al., 2004).

Previous research found a stage effect when comparing smokers in precontemplation to those in contemplation but failed to find a stage effect for those in contemplation compared to those in the preparation stage (Farkas et al., 1996). The lack of evidence of a stage effect in smoking cessation led Farkas and colleagues (1996) to reject the TTM in favor of a set of addiction variables for understanding smoking cessation. These mixed results raised the question as to how consistent stage effects really are. Prochaska et al. (2004) conducted a study in order to investigate stages effects in a variety of participants. The researchers examined how consistent stages effects really are by seeing if those in precontemplation quit less than those in contemplation and those in contemplation quit less than those in preparation. Prochaska et al. (2004) also looked at how much more quitting occurs in smokers in the preparation stage compared to the contemplation stage and in the contemplation stage compared to the precontemplation stage.

The baseline measure in this study found 37.9% of the participants to be in the precontemplation stage, 44.8% in contemplation, and 17.3% in the preparation stage. The follow up measures found that smokers in contemplation at baseline compared to

those in precontemplation had quit rates that were 86.5%, 101.1%, and 66.4% greater at the six, twelve, and eighteen month follow ups (Prochaska et al., 2004). The smokers in preparation compared to those in contemplation had quit rates that were 78.5%, 62.7% and 52.5% higher at the six, twelve, and eighteen month follow ups respectively (Prochaska et al., 2004). Prochaska and colleagues found stage effects in their results. The stage effects comparing precontemplation and contemplation were smaller than the stage effects for contemplation to preparation at each follow up. The stage effects for precontemplation to contemplation were greater than the stage effects for contemplation to preparation at each follow up. Another important finding is that there was a high (94%) consistency of the TTM of stage effects. This means that those in precontemplation had quit less than those in contemplation and those in contemplation quit less than those in preparation at each follow up which is expected for a stage effect to occur. These results provide support for intervention programs that can help individuals progress through the early stages. By assisting those with a problem behavior such as smoking, moving one stage could produce up to 75% more abstinence and progressing two stages could produce 300% more abstinence (Prochaska et al., 2004). Given that in the USA 80% of smokers are in precontemplation or contemplation, an intervention could produce substantial improvement in smoking cessation.

The TTM of behavior change can be applied to a variety of problem behaviors including smoking cessation, quitting cocaine, weight control, high fat diets, adolescent delinquent behaviors, safe sex, condom use, sunscreen use, radon gas exposure, exercise acquisition, mammography screening, and physicians' preventive practices with smokers (Prochaska et al., 1994). In the same article by Prochaska and colleagues, the researchers

presented data on the relationship between the stages of change and two scales from the decisional balance measure for the above twelve problem behaviors. The researchers' objective was to investigate the generalizability of findings across the twelve problems behaviors and their ability to integrate core constructs from alternative models (Prochaska et al., 1994). The researcher's contend that if relationships between the stages of change and decisional balance can be found to generalize across a wide range of behavioral problems and a variety of samples, then strong evidence will be provided for the generality of the TTM (Prochaska et al., 1994).

With regard to smoking cessation behavior, previous research has demonstrated how people quit smoking on their own. The evidence showed that smokers move through a series of stages of change in their attempt to quit smoking (DiClemente & Prochaska, 1982). The stages of change can be integrated with two measures of the decisional balance construct (pros and cons) to give a more critical understanding of how the core constructs in the TTM work together.

The pros and cons from the decisional balance vary in how they relate to the stages of change that each individual are involved in. For those individuals that are in precontemplation, the pros of the problem behavior outweigh the cons (Prochaska et al., 1994). In both the action stage and maintenance stage individuals will conclude that the cons of the problem behavior as outweighing the pros (Prochaska et al., 1994). If both of these accounts hold true then the pros and cons of any of the twelve problem behaviors would cross over in either the contemplation stage or the preparation stage (Prochaska et al., 1994). In this study, Prochaska and colleagues were looking to see if any relationships could be found between the stages of change and the pros and cons of the

decisional balance across the twelve problem behaviors. If a connection between the stages of change and the pros and cons is provided then strong evidence would exist for the ability of the TTM to integrate core constructs from other alternative models of behavior change (Prochaska et al., 1994). There would also be evidence of how individuals make decisions at certain stages of change.

During the study Prochaska et al. (1994) used a 4 or 5 item algorithm to determine what stage of change each participant was in. The items asked if participants currently had the problem behavior or had they engaged in the desired positive behavior. If participants reported the problem behavior and that they didn't intend to change within the next six months they were in the precontemplation stage (Prochaska et al., 1994). If the participants intended to change in the next six months they were considered to be in the contemplation stage (Prochaska et al., 1994). For participants to be in the preparation stage they had to indicate that they were planning to change in the next month or had made some sort of small changes but did not meet any of the higher stages of change criterion (Prochaska et al., 1994). If the participants were in the action stage they had already reached a particular criterion such as quitting smoking within the past six months (Prochaska et al., 1994). Finally, if the participants were in the maintenance stage, they had reached criterion six months prior to the study (Prochaska et al., 1994). The studies also included Janis and Mann's (1977) decision making categories in order to classify the pros and cons of the decisional balance.

The results of the study by Prochaska and colleagues indicated that the cons of changing the problem behavior were higher than the pros for participants who were in the precontemplation stage. The opposite pattern was true for the participants in the action

stage (expect for those quitting cocaine). Another important finding was that the pros of changing the problem behavior were higher for participants in the contemplation stage than for those in the precontemplation stage. No consistent pattern was found for the differences between contemplation and precontemplation stages on the cons of changing the problem behavior. However, there was a consistent pattern of change of differences in the cons of changing between participants in the contemplation stage and those in the action stage. The cons were lower for participants in the action stage than for those in the contemplation stage. One the pros of changing the problem behavior there was no pattern of differences between participants in the contemplation stage and those in the action stage.

Internal validity of the two factor decisional balance model was supported across each of the studies, including smoking cessation (Prochaska et al., 1994). The pros and cons were found to be clearly represented as decisional categories for making behavior changes across the stages of change. The pros of changing were all higher in the contemplation stage than in precontemplation which suggests that progress from precontemplation to contemplation involves an increase in the evaluation of the pros of changing (Prochaska et al., 1994). The cons of changing are lower in the action stage than in the contemplation stage which suggests that the progression from contemplation to action involves a decrease in the cons of changing (Prochaska et al., 1994). The increase in the pros followed by a decrease in the cons leads to a crossover in the decisional balance from the cons being greater in precontemplation to the pros being greater in the action stage. Interventions should target increasing the pros of changing, which should lead to a progression from precontemplation to contemplation.

Interventions should then target decreasing the cons of changing, which should lead to further progress from contemplation to action. There is strong support here for the generalizability of three basic constructs of the TTM: stages of change, pros and cons, and the integration between the stages and the decisional balance variables (Prochaska et al., 1994).

The stages of change have been established by two different self report methods. The first is a discrete categorical measure which evaluates the stage from a chain of mutually exclusive questions. The second is a continuous measure that finds separate scales for precontemplation, contemplation, preparation, action, and maintenance (DiClemente, Prochaska, Fairhurst, Velicer, Velasquez, & Rossi, 1991). Research on the stages of change has been supported in both therapy and in self changers (Prochaska et al., 1992). In order for successful change in smoking behavior it usually takes from three to four action attempts before an individual becomes a long term maintainer (Schachter, 1982). It is not uncommon for individuals to relapse and go through the stages quite frequently as they try to quit their problem behavior. This is also known as the spiral pattern of change (Prochaska et al., 1992).

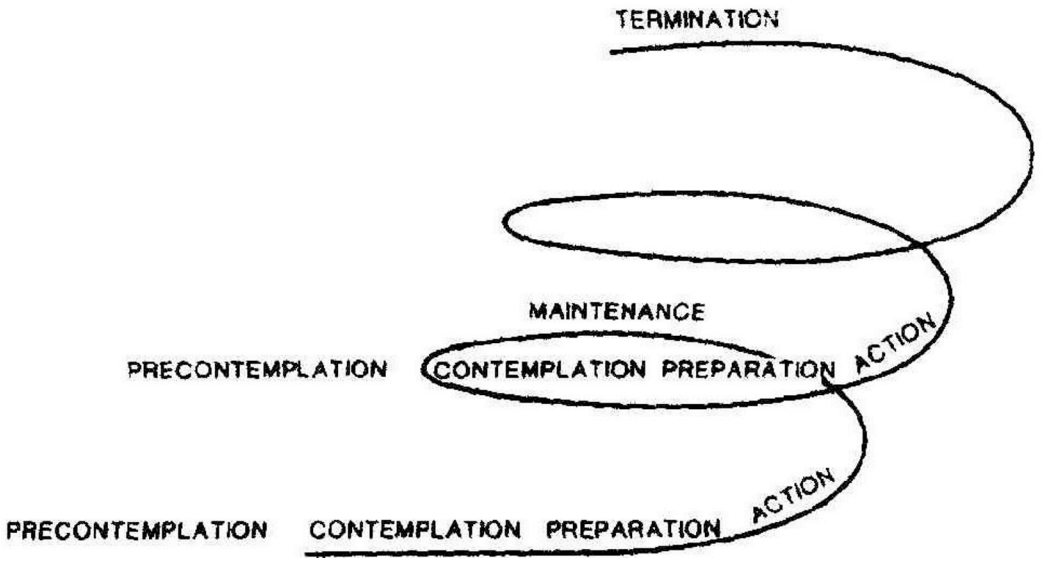

Figure 3. Spiral Pattern of Change (Prochaska et al., 1998).

Individuals can progress completely through the stages of change right from precontemplation to maintenance but most will experience some sort of relapse. Some individuals who relapse begin to feel like failures and then will change their minds about changing their problem behavior and revert back into precontemplation.

In the social sciences, it is believed that the integration of various systems of treatment for problem behaviors can enhance the cessation of a problem behavior. By integrating the stages of change and the processes of change researchers are able to discover a better understanding of the how these core constructs interact and support each other in behavior change. The processes of change have been found to be better predictors of the progress across the stages of change than a set of seventeen other predictor variables including demographics, health history, and problem history (Prochaska et al., 1992). When Prochaska and colleagues integrated the stages of change with the processes of change they found a variety of interesting results. Individuals in the precontemplation stage processed less information about their problems, devoted less

time and energy to reevaluating themselves, and experienced fewer emotional reactions to the negative aspects of their problems (Prochaska et al., 1992). They were less open with significant others about their problem and did little to change their attention to their environment in the direction of attempting to overcome their problems.

In the contemplation stage, individuals were most open to consciousness raising (Prochaska & DiClemente, 1984). The contemplators were also open to dramatic relief experiences, which raise emotions and led to a lowering of negative affect if the individual changes. The more conscious a person is, the more likely they are to reevaluate their problem behavior. Movement from precontemplation to contemplation requires an increase in cognitive, affective, and evaluative processes of change (Prochaska et al., 1992). In addition, individuals in the preparation stage begin to take small steps towards action. They use counterconditioning and stimulus control to begin reducing their use of cigarettes. During the action stage participants supported higher levels of self liberation (Prochaska et al., 1992). They increasingly began to believe that they had the independence to change their own behavior. Success in the action stage also included effective use of behavioral processes such as counterconditioning and stimulus control to change the stimuli that brings about a relapse. Action is a stressful stage where individuals rely on social support and understanding from helping relationships (Prochaska et al., 1992). Successful maintenance builds on each of the processes that came before it. Specific preparation for maintenance includes an assessment of the conditions under which an individual was most likely to relapse and develop alternative responses for coping with conditions without resorting to self defeating defenses and pathological responses (Prochaska et al., 1992). Continuing to apply counterconditioning

and stimulus control was the most effective when it was based on the assurance that maintaining change supports a sense of self that was highly valued by the individual and others.

Prochaska and colleagues (1992) also found that many of the processes of change did not increase linearly. Self reevaluation, consciousness raising, and dramatic relief (associated with contemplation) demonstrated significant decreases as self changers moved through the action stage to maintenance (Prochaska et al., 1992). Self liberation, stimulus control, contingency control, and counterconditioning (associated with action) increased as self changers moved from contemplation to action (Prochaska et al., 1992). These change processes were then leveled off or decreased when maintenance was reached. Self changers seemed to increase cognitive processes most important in contemplation and then increase more behavioral processes in the action and maintenance stages.

Prochaska, Velicer, Guadagnoli, Rossi and DiClemente (1991) set out to conduct a comprehensive study on the various patterns that appear when individuals attempting to change a problem behavior. The researcher's examined the ten processes of change, self efficacy, temptations to smoke, and the pros and cons of smoking behavior in a longitudinal study. Theoretical and practical significance were found for these 14 behaviors because they can be adapted in both self change and professional approaches to overcoming problem behaviors (Prochaska et al., 1991). This allowed for the researchers to use to new research methods. The first method that they employed was called a dynamic typology. This strategy assumes that individuals can be placed in one of many stages at different points in time (Prochaska et al., 1992). Individuals are clustered into

groups that share similar patterns of change across time. Based on dynamic typology several patterns were expected to emerge. Prochaska and colleagues expected to find (1) stable profiles, individuals will stay in the same stage throughout all assessment points; (2) linear progression, participants who begin in action will progress to maintenance; and (3) unstable progression, which mean that participants who begin in contemplation will progress to action and then regress to contemplation or precontemplation. The second methodology the researchers used combined cross-sectional and longitudinal aspects, (Schaie & Strother, 1968). This method involved following different groups at different points in time and then combining them to create a developmental profile. Prochaska and colleagues designed the study to develop composite patterns of change for the 14 variables during a two year study of self change approach to smoking cessation involving five separate assessments.

The participants in the study were divided into five different groups based on their smoking behavior (Prochaska et al., 1992). There were immotive smokers, which are analogous to those in the precontemplation stage who were currently smoking and had no intention of quitting. The contemplation stage was made up of a group who were currently smoking but considering quitting in the next year. Another group was labeled as the recent quitters (action stage) who had quit smoking without treatment in the past six months. Finally, there were those that represented the maintenance stage and they were called the long term quitters. These participants had quit smoking on their own and did not smoke at least six months prior to the study. A final group of participants were the relapsers. These individuals were able to initially quit on their own but then had a relapse and continued smoking.

Prochaska and colleagues used the processes of change, the decisional balance scale, as well as the self efficacy scale and temptation scale to investigate the patterns of change in the participants. In addition to the ten processes of change, two second order factors were included in the model (Prochaska et al., 1992). The first factor was labeled as experiential since it joined five processes of change that are cognitive (Prochaska et al., 1992). These processes include conscious raising, self-reevaluation, dramatic relief, environmental reevaluation, and social liberation. The second factor was labeled as behavioral since it shared the five other processes that have been found to be more action related (Prochaska et al., 1992). These processes include counterconditioning, stimulus control, reinforcement management, self-liberation, and helping relationships. The decisional balance scale was used to assess the pros of smoking and the cons of smoking like that in Prochaska et al. (1994). For the self efficacy and temptation scale, a similar measure was used to assess both constructs. After each item was presented to participants they were asked to rate their degree of certainty that they could avoid smoking in that situation and their degree of temptation to smoke in that particular situation (Prochaska et al., 1992). A five point Likert scale was used for this measure (1 = not confident to 5 = extremely confident; 1 = not tempted to 5 = extremely tempted).

The results indicated that three distinct patterns occurred. Some participants remained flat and did not alter the stage of change that they began the experiment in. Another group of participants were unstable and when these participants changed a stage they ultimately returned to that previous stage. Finally, the remaining participants illustrated signs of linear progression and increased or decreased in the stages of change without any turnarounds.

When examining the results from the experiential processes of change consciousness-raising, dramatic relief, and environmental evaluation showed a common curvilinear pattern (Prochaska et al., 1992). What this means is that these processes were used at low levels during precontemplation and then increased dramatically for those individuals who progressed from contemplation to action. After peaking, these processes decreased during the action and maintenance stages and gradually returned to precontemplation levels. Self reevaluation also showed an increase in the contemplation stage to action but the increase only continued until individuals progressed to maintenance and the use of self reevaluation declined to precontemplation levels. Social liberation was the only process of change that did not follow a curvilinear pattern. Social liberation was at its highest peak during precontemplation and declined all the way to the maintenance stage.

When examining the results from the behavioral processes of change each of the five processes (counterconditioning, stimulus control, reinforcement management, self-liberation, and helping relationships) followed a similar curvilinear pattern of low usage in precontemplation, an increase during contemplation, and peaking in action (Prochaska et al., 1992). However, a few of the processes differed. Helping relationships differed in that it peaked during the contemplation stage. Rather than declining to precontemplation levels, self liberation and stimulus control remained high during maintenance. This may be considered a relapse prevention strategy (Prochaska et al., 1992). Reinforcement management peaked in action and declined during maintenance and counterconditioning stayed high in early maintenance but declined later on.

The results of the self efficacy and temptation scale were much easier to interpret. Both scales followed a linear pattern across the stages of change (Prochaska et al., 1992).

Self efficacy increased linearly across the stages of change as participants progressed from precontemplation, to contemplation, to action, and finally to maintenance. The same linear pattern appeared for the temptation scale.

The decisional balance variables changed the most when participants progressed across the stages of change. The pros of smoking outweighed the cons of smoking when participants were in the precontemplation stage but as they moved into the contemplation stage, the cons of smoking outweighed the pros of smoking. These results show that in the TTM model, all the core constructs can be integrated and that they play a key role together in behavior change. Additionally, the results indicate that the TTM, particularly the processes of change, are emphasized during certain stages of change (Prochaska et al., 1992). These results are helpful for indicating which processes of change peak at different stages of change and more emphasis can be placed where the processes of change are at their strongest.

Noel's Unfolding Analysis of Smoking Cessation

Although the unfolding model was specifically designed for attitudinal data it has been applied to developmental data as well (Noel, 1999). The unfolding model is relevant to developmental data analysis whenever processes characterizing each stage are supposed to successively replace processes characterizing previous stages (Noel, 1999). Participants will specify a greater use of processes characterizing a stage they are in, and a lower use of processes characterizing both lower and upper stages, thus displaying a unimodal distribution of their ratings on each process (Noel, 1999). Such a developmental model relies on a different conceptualization of psychological change than do the more popular known cumulative models. In cumulative models, each stage is

assumed to prepare the following in an integrative manner so that earlier stages remain embedded in the later stages. In unfolding models each stage is preparing the following while inhibiting the previous ones. The unfolding model of change assumes that some processes are relevant in a given stage but no longer relevant as an individual shifts along the continuum (Noel, 1999).

In the measurement of change, one must reformulate the unfolding model of data as resulting both from a cumulative mechanism and from the negative feedback of each new process of change on the previous one in the change sequence (Noel, 1999). Noel (1999) provided an example: negative emotionality towards one's behavior (smoking) may result in a search for social support which in turn will diminish the negative emotional response. Social support may in turn increase involvement in personal action (counterconditioning) which will finally diminish the need for social support. The resulting pattern of intensity variation with time for each of these processes will be bell-shaped, first increasing up to a maximum then decreasing (Noel, 1999).

From the IRT perspective, once a theoretical probability model is designed, the parameters are estimated following the maximum likelihood approach. The interesting property of the model is that participants and items play a symmetric role: They are both projected onto a common unidimensional space (Noel, 1999). It then becomes purposeful to calculate a "distance" between a participant and an item, which cannot be accomplished using classical factorial models. The general property of unfolding models is to allow for the simultaneous projection of participants and items onto a common subspace (Noel, 1999). It is also acceptable to present unfolding analysis as a joint scaling of participants and items.

The patterns of the ten processes of change are found to be curvilinear (Prochaska et al., 1991). This means that during certain stages of change some processes are more important and as an individual moves into the later stages of change the process becomes less important and it will decline. The stage concepts are considered as an approximation of a smoker's position along a the dimension (Noel, 1999). A numerical estimation of this position, provided it has a relationship to smoking cessation, would represent a change maturity index that would make it possible to improve diagnoses and construct more specific intervention strategies. From this line or reasoning an item such as *"My dependency on cigarettes makes me feel disappointed in myself"* is likely to be rejected because the smoker doesn't consider smoking as a serious problem or because s/he has gained control over the addiction and has fewer reasons to be disappointed (Noel, 1999). Responses to change items are then determined by two latent sources of refusal: low and high maturity of change, relative to the level of maturity specified by this item (Noel, 1999). These are the two disagree-from-below and disagree-from-above kinds of responses described by Andrich and Lou (1993).

According to Noel (1999), it is noteworthy that this case where the latent dimension is of temporal nature, below and above, meaning before and after respectively, so that making underlying sources of disagreement explicit in the response format would not yield unfolding data: It is unlikely that smokers will be aware that they disagree with the item because they have yet to reach the stage of change that would make the attitude available. Individuals cannot anticipate a stage of change that they have not yet reached. Therefore there is a fundamental asymmetry in the psychological perception of the

change dimension due to its temporal nature (Noel, 1999). So applying the GUM to change data is justified.

Noel (1999) used a French version of the Processes of Change Questionnaire which was given to 140 smokers as part of an initial assessment session of three session hypnotic treatment for smoking. The questionnaire was designed to measure the processes of change. The GUMJML software provided by Roberts (1998) was used to analyze the data. The software uses Roberts and Laughlin's (1996) GUM by the method of joint maximum likelihood (JML) estimation. Noel (1999) anticipated the resulting item ordering to reflect reasonably well the longitudinal data reported by Prochaska et al. (1991) and it was also expected that participant's locations on the unfolding dimension to be significantly related to actual quitting. Treatment outcome was coded as 1 for participants having not smoked at all for at least seven days after the end of the program and 0 for participants who dropped out our failed to quit smoking (Noel, 1999).

Results indicate that 13 out of the 40 items saw poor fit to the model. Social liberation and counterconditioning appear to be the most poorly represented (Noel, 1999). This may be due to culture since social pressure against smoking has not been as important in the France as in North America. Since this sample was recruited in a clinical context participants were unlikely to express opinions and attitudes that are characteristic of the earlier stages of change and they were unlikely to engage in behaviors that are more characteristic of recent quitters (Noel, 1999). Consequently, one may expect the most extreme items at both ends of the continuum to be poorly scaled.

Noel (1999) validated the data in his study by checking process ordering recovered by unfolding analysis with the ordering emergent from previous longitudinal

studies (Prochaska et al., 1991). Dramatic relief is the first process on the left end of the latent dimension and is closely followed by social liberation. These two processes were representative of early stages of change in Prochaska et al. (1991). Environmental reevaluation appeared as the next process, which had been previously described as characteristic of the end of the contemplation stage. Self reevaluation and reinforcement management the next to appear together and are in good convergence with previous longitudinal studies (Prochaska et al., 1991). The unfolding model located helping relationships in this region where they had been previously located in earlier stages of change. When taking a closer look at helping relationships, a bimodal cure appears with one peak in the contemplation stage and another in the action stage. Helping relationships items may cover external incitement to change or support. It doesn't seem too hard to believe that helping relationships is located close to reinforcement management, of which three of four items involve being rewarded by someone else. However, unfolding estimates were in divergence with the longitudinal data. Stimulus control is the predominant change process of the action stage as expected. Self liberation and counterconditioning, described as characteristic of the last steps in the change process, are positioned on the extreme right.

The change dynamics can be summarized by the following sequence: (a) negative evaluation of present behavior, (b) information taking, (c) positive reevaluation of change, and (d) action. Other formulations are also possible: From left to right, participants are moving from negative (dramatic relief) to positive emotionality (reinforcement management and helping relationships) and form cognition (information processing) to action (counterconditioning). Noel (1999) notes that any arbitrary

segmentation of the continuum would be relevant and that the present analysis has the advantage to regain a continuous dimension rather than a stage sequence.

Noel (1999) then examined the link of participants' parameters with an external behavioral criterion, just like when there was a check of the convergence of item parameter with the longitudinal data. For each participant, cessation of failure had been registered. Those who quit are located significantly closer to the right end of the cognitive behavioral continuum. There appears to be an increasing pattern of success probability emerging as a function of participants' location. Both external validation criteria and the item subject level strongly support the relevance of the unfolding model in the study of change in smoking cessation.

This study will use Noel (1999) study as a template with a sample of young Canadian adults with various experiences with smoking. More specifically, this study will investigate whether the unfolding model can account for the interaction between the stages and processes of change, as was found in Noel (1999). Although the Processes of Change Questionnaire and the Stages of Change were not specifically developed to be measured by an unfolding model, this study will attempt to confirm the pattern found by Noel (1999).

This chapter has summarized various attitudinal measurement approaches including the Likert, Thurston, and the Graded Unfolding Model. A review of the literature also included the core constructs of the transtheoretical model. The next chapter outlines the methodology used in the study.

Chapter Three

Methodology

This chapter details the methodology that was used to collect and analyze the data to answer the research questions outlined earlier. This chapter is divided into sections of the research design which include the participants, materials and instruments, procedure, analysis, and GGUM output.

Participants

Participants were recruited from undergraduate classes in the College of Education, the College of Arts and Science, the College of Physics, and the College of Commerce at the University of Saskatchewan. The professor of each class was contacted either by e-mail or by phone in order to obtain approval to come into the classroom to recruit potential participants. A total of 251 participants were recruited, with 97 having some current or previous type of smoking experience. A sample of this size is required for three reasons: (1) Roberts and Laughlin (1996) reported that accurate estimates of GUM parameters can be obtained with a sample size of 100 (Roberts & Laughlin, 1996); (2) the study by Noel (1999) had 140 participants; and (3) the desire to have at least 15-20 participants across each of the five stages of change. Although the university student sample was a convenient, it did allow for a large number of participants to be recruited and increased the likelihood of obtaining participants that represented all five stages of change. Furthermore, according to the American Cancer Society more than 80% of adults who have ever smoked cigarettes were introduced to them by the age of eighteen, and more than half were already smoking by this age (American Cancer Society, 1998). In addition, Health Canada (2000) reported that 25% of Canadian teens 15-19 years old

and 32% of young Canadians 20-24 years old were smokers. Despite the convenience of the sample, it was still a good population to recruit individuals with smoking experience since undergraduate students are typically eighteen years of age or older.

Materials/Instruments

The Processes of Change Questionnaire (Prochaska et al., 1988) for smoking was provided to each of the participants. This 40-item questionnaire is intended to measure the ten change processes in smoking cessation. Each process is measured separately using four items. The questionnaire for is considered highly reliable and valid. Internal consistency was established with alpha coefficients of the four item process scales ranging from .69 to .92, with only social liberation and reinforcement management having alpha coefficients less than .80 (Prochaska et al., 1988). Content validity of the questionnaire was established by having four trained judges select items from a pool and assign them to a process (Prochaska et al., 1988). Convergent validity coefficients ranged from .34 to .72 for the coefficients, with most values around .60 (Prochaska et al., 1988). These results support the construct validity of the measure.

The participants were also asked to complete the Stages of Change Questionnaire (see Appendix A) which includes five different statements that are representative of the five stages of change (precontemplation, contemplation, preparation, action, and maintenance). Both the Process of Change Questionnaire (see Appendix A) and the Stages of Change question sheet were presented together in a booklet for participants to complete.

Those willing to participate were also asked to complete a short demographic section. Participants were asked to indicate their date of birth, gender, and their

university major. Participants were not asked to write their name or any other information that could identify them individually.

Procedure

A participant recruitment letter (see Appendix B) was read aloud to the entire class. This letter provided a brief description of the study, what participation entailed, and contact information including the University of Saskatchewan Behavioral Research Ethics Board phone number. When participants agreed to partake in the study, they received and completed two consent forms. One consent form was returned to the researcher, separately from the questionnaire package, and the second form was for the participants own records. The participants completed the questionnaire in the classroom they were in. After completing the questionnaire, participants received a debriefing statement in the form of a short letter stating the purpose and expectations of the study. The researcher's and supervisor's contact information were provided if the participants desired any further information or wanted to be informed on the final results of the study.

Analysis

Once all data was collected from the questionnaires, it was scanned using the Remark Office OMR computer program (Remark Office OMR, 2005). The Remark Office OMR is a software package created to collect data from marks (bubbles or checkboxes) and barcodes on paper forms. The software works in union with an image scanner to collect the data directly from the participants' completed questionnaire. The software allows for 100% data verification analysis of the data and the transfer of data to other software programs. This program eliminates data entry error when transferring the data from the questionnaires to an analysis program. If problems arise with the data entry

during the scan, for example if certain data is not fully shaded in using the bubble marking, the software program will alert the user.

After all of the data was entered into the Remark Office OMR software program the data was transferred to the Statistical Package for the Social Sciences (SPSS, 2006). Once the data was transferred into SPSS, preliminary data cleaning took place. The data was examined for any missing data, outliers, and normality. After data cleaning, descriptive statistics and frequency distributions were conducted on the demographic items of the Stages of Change and the Processes of Change for smoking.

The data from the Processes of Change Questionnaire and Stages of Change question sheet were transferred into the Generalized Graded Unfolding Model 2004 (Roberts, 2005) computer software program created by Roberts (2006). The software uses Roberts and Laughlin's (1996) GUM using joint maximum likelihood (JML) estimations. This is the only existing software that can estimate an unfolding model using an IRT perspective and thus comparisons can not be made with any other measures (Noel, 1999).

After standardization, the scores were recoded into five categories (i.e., "0" became -4 to -1.2; "1" became -1.19 to -.20; "2" became -.19 to .80; "3" became .81 to 1.80; and "4" became 1.81 to 4). The cut points were selected to ensure that all possible scores were included in the standardization ranges. When Noel (1999) standardized the scores in his study, he did not specify which values were assigned to each category range, thus the output described in his study were opposite in polarity. During a preliminary analysis of the data, it was found that participants did not use category 4 frequently, so the label was removed and combined with category 3, which then described the range of

.81 to 4.

The data was then analyzed for each of the processes of change using a number of statistics including a comparison against a perfect model, item parameter estimates, standardized infit and outfit indexes, standardized infit and outfit chi-square, and comparison with prior data. Each process of change was measured by the four items that represent it. Further data analysis was conducted to distinguish whether the unfolding model can account for the interaction between the stages and processes of change.

GGUM Output

GGUM Model. The GGUM2004 program is able to estimate eight different models through constraints on alternative item parameters (Roberts, 2005). The models are generically called Models 1-8. The models differ in what is assumed about subjective response category thresholds and item discrimination parameters (Roberts, 2005). In the current study Model 1 was used to analyze the data. The first model was used because Roberts (2005) suggested using the most general model for analysis (Model 1). Model 1 gives equally spaced thresholds for each item but all items have the same lambda (Roberts, 2005).

Comparison Against a Perfect Model. Henard (1998) noted that the object of the perfect model is to predict performance based on item calibrations that are independent of the participants giving the responses and that their attitude estimates are independent of the items used during measurement, and all items that are answered exactly the same by all participants are removed from future analysis. According to Henard (1998), both attitudes and abilities must be continuous and in the same metric, which is done by

converting the values so they have the same mathematical proportions in order to determine participants' attitudes.

Additionally, the measurement of item difficulties (attitudes) must be corrected for the difficulty dispersion of the items (Henard, 1998). Initial measurement of participant ability needs to be corrected for the ability dispersion of the participants. The computations result in item calculations that are corrected for the sample and in person calculations that are corrected for the test (Henard, 1998). These calibrations are necessary because the difficulty level of the items depend on the variance in the ability levels of the participants, and the calculation of the apparent person ability level depends upon the variance in test item difficulty (Henard, 1998). If there is a large variance in the ability level of the participants taking the test (survey), then the item difficult levels appear similar across all items (Henard, 1998). Similarly, the greater the variance in item difficulty levels on the test, the more similar the ability levels of participants appear (Henard, 1998). The effects of participant spread and test width must be eliminated from the estimates for person ability and item difficulty to ensure the final estimates are realistically thought to be both participant free and item free (Henard, 1998).

The final step is then to fit the model to the data and evaluate the model's goodness of fit (Henard, 1998). A computer software program can then identify discrepancies between the specified model and the existing data for the source of the variance can be explored (Henard, 1998). Henard (1998) claims that it can be helpful to think of the process as a chi-squared test in which the goodness of fit between the model and data is tested and any sources of misfit are identified and can be removed from the data.

Item Parameter Estimates (Location). According to Roberts et al. (2000) item parameters can be estimated using a marginalized maximum likelihood (MML) approach (Bock & Atikin, 1981; Bock & Lieberman, 1970). In this technique, the location of the individual on the continuum are integrated out of the likelihood function by specifying a prior distribution and then integrating over this distribution using a quadrature (Roberts, Donoghue, & Laughlin, 2002). The MML estimates of the item, item discrimination, and the subjective category threshold parameter associated with the item are found by maximizing the logarithm of the marginal likelihood function (Roberts et al., 2002). Item parameter estimates (location) will be given for each of the 40 processes of change items. The items will be grouped according to their 10 process of change and ordered based on group averages in descending order.

Standardized Infit Index. Infit indexes measure the difference between observed data and the theoretically anticipated response function (Noel, 1999). According to Linacre and Wright (1994), the infit index is a squared standardized residual that is weighted by the theoretically anticipated information at each item location. The infit index is inlier-sensitive or information weighted fit (Linacre, 2002). This means that the infit index is more sensitive to the pattern of responses to items directed on the person (Linacre, 2002). An example provided by Linacre (2002) states that infit indexes reports overfit for Guttman modelan patterns and underfit for alternative curricula or idiosyncratic clinical groups.

Standardized Outfit Index. The outfit index is an outlier-sensitive fit (Linacre, 2002). According to Linacre (2002), the outfit index is more sensitive to items with difficulty far from the person. For example, Linacre (2002) states that outfit reports

overfit for ascribed responses and underfit for mistakes and guesswork. In the standardized form, both the infit and outfit indexes are assumed to have a mean near zero and a variance near unity and can be thought of like a Student's *t*. Standardized fit statistics are *t* tests that measure the hypothesis "Does the data fit the model?" (Linacre, 2002).

Item Chi-Square. As with the infit index, chi-square measures the difference between observed data and the theoretically anticipated response function (Noel, 1999). When using chi-square (x^2), instead of measuring each value from a set of items, the calculated value of x^2 compares frequencies of variables or categories of items from a random sample to the expected frequencies (Hayduk, 1987). In other words, x^2 is used to assess how well the obtained data from what is expected to occur. Additionally, smaller values of x^2 demonstrate better fitting models, and that a non significant x^2 is preferred (Hayduk, 1987).

Likelihood Ratio for x^2 Item Fit Conditioned on Total Score (Sx^2). Generalizing from Orlando and Thissen (2000), Sx^2 is approximated by an x^2 distribution under the null hypothesis of perfect fit (Roberts, 2005). In communication with the GGUM2004 developer Dr. James Roberts, he suggested that this measure should be used since it is better than the item level likelihood ratio chi-square tests. Additionally, it is important to note that the distributional assumptions for all fit statistics have not been vigorously studied (Roberts, 2005). All of the fit statistics test the null hypothesis of perfect fit and the model never fits any data perfectly (Roberts, 2005).

Comparison With Previous Data. The current studies results were compared with the results obtained by Noel (1999). Additionally, both studies were compared to the

original theory of the Stages and Processes of Change proposed by Prochaska et al. (1992).

One piece of analysis that Noel (1999) used that will not be employed in the current study is Andrich's x^2 (1978). Noel computed Andrich's x^2 by sorting participants by increasing location along the continuum and clustered in seven consecutive class intervals of 20 participants each. For each class, a mean observed rating, the expected rating, and the theoretical standard errors under the model were computed. The difference between the expected and observed ratings given the theoretical variance, was used to computed chi-square. There are two reasons Andrich's x^2 will not be used in the current study. First, DeMars (2004) found that in both a simulation study and using a real data set, Andrich's x^2 identified high Type I Error rates which led to the rejection of too many items. Furthermore, communications with GGUM2004 developer Dr. James Roberts, commented that Andrich's x^2 is no longer used because of poor performance with the model.

This chapter has summarized the methodology that was used to collect and analyze the data. In the next chapter, the results of the data analysis are presented.

Chapter Four

Results

This chapter presents the results for the data analysis. Included in the results are tables and description of participant demographics, frequencies of the processes of change, item parameter estimates and fit statistics, items' location and wordings, and a comparison with prior data.

Participants were asked to provide demographic information based on gender, age range, and university program, which can be found below in Table 2. The demographics revealed that 42.3% of the survey participants were male and 57.7% were female. The greater proportion of participants were between 18 and 21 years of age (62.9%), followed by those who were 20 to 21 years old (28.9%), and those who were 26 years and older (8.1%). Most of the participants were in the College of Arts and Science (55.7%), followed by those in other Colleges (18.6%), the College of Education (13.4%), and the College of Commerce (12.4%). Most participants indicated that the stage that best represented them was Maintenance (49.5%), followed by Precontemplation (17.5%), Contemplation (13.4%), Preparation (11.3%), and Action (8.2%).

Table 2: Participant Demographics

Demographics	N	Percent
Gender		
Male	41	42.3
Female	56	57.7
Total	97	100
Age Range		
18-21 yrs	61	62.9
22-25 yrs	28	28.9
26 yrs and up	8	8.1
Total	97	100
University Program		
Arts & Science	54	55.7
Education	13	13.4
Commerce	12	12.4
Other	18	18.6
Total	97	100
Stage of Change		
Precontemplation	17	17.5
Contemplation	13	13.4
Preparation	11	11.3
Action	8	8.2
Maintenance	48	49.5
Total	97	100

A description of the Process of Change items are presented in Table 3. This table represents the range, minimum score, maximum score, mean, and standard deviation for each of the processes. The items are listed in the left hand column in numbered order. Items 1-4 represent Conscious Raising, items 5-8 represent Self Liberation, items 9-12 represent Dramatic Relief, items 13-16 represent Environmental Reevaluation, items 17-20 represent Helping Relationships, items 21-24 represent Stimulus Control, items 25-28 represent Counterconditioning, items 29-32 represent Social Liberation, items 33-36 represent Self Reevaluation, and items 37-40 represent Reinforcement Management. The stems for each item are available in Appendix A.

Table 3: Unstandardized Process of Change Statistics

Item	N	Range	Minimum	Maximum	Mean	Std. Deviation
CR1	96	3	0	3	1.69	1.07
CR2	97	2	1	3	1.88	.90
CR3	96	2	1	3	1.86	.88
CR4	95	3	0	3	1.72	1.07
SL5	94	3	0	3	1.88	1.15
SL6	91	3	0	3	1.77	1.18
SL7	90	3	0	3	1.82	1.16
SL8	95	3	0	3	1.91	1.20
DR9	96	3	0	3	1.77	1.05
DR10	96	3	0	3	1.66	1.11
DR11	96	3	0	3	1.70	1.21
DR12	93	3	0	3	1.68	1.10
ER13	96	3	0	3	1.61	.98
ER14	95	3	0	3	1.55	1.04
ER15	92	3	0	3	1.68	.99
ER16	94	3	0	3	1.62	1.08
HR17	91	3	0	3	1.74	1.05
HR18	92	3	0	3	2.14	1.00
HR19	89	3	0	3	1.76	1.15
HR20	85	3	0	3	1.64	1.22
SC21	88	3	0	3	1.74	.86
SC22	87	2	1	3	1.68	.79
SC23	87	2	1	3	1.64	.79
SC24	85	2	1	3	1.66	.77
CC25	88	2	1	3	1.65	1.00
CC26	87	3	0	3	1.92	.88
CC27	86	2	1	3	1.48	1.19
CC28	81	3	0	3	1.69	1.09
SOC29	91	3	0	3	1.53	.77
SOC30	91	2	0	2	1.69	1.21
SOC31	90	3	0	3	1.47	.78
SOC32	90	2	0	2	1.48	.67
SR33	82	2	0	2	1.60	.80
SR34	83	2	1	3	1.64	.79
SR35	79	2	1	3	1.71	.80
SR36	79	2	1	3	1.66	.88
RM37	85	2	1	3	1.62	.82
RM38	82	2	1	3	1.65	.87
RM39	84	2	1	3	1.67	.87
RM40	84	2	1	3	1.68	.89

*Note. CR=Conscious Raising, SL=Self Liberation, DR=Dramatic Relief, ER=Environmental Reevaluation, HR=Helping Relationships, SC=Stimulus Control, CC= Counterconditioning, SOC=Social Liberation, SR=Self Reevaluation, and RM=Reinforcement Management.

A description of the Process of Change items in standardized form (Mean = 0, Standard Deviation = 1) can be found below in Table 4. This table represents the range, minimum score, and maximum score. The items are listed in the left hand column in numbered order. Items 1-4 represent Conscious Raising, items 5-8 represent Self Liberation, items 9-12 represent Dramatic Relief, items 13-16 represent Environmental Reevaluation, items 17-20 represent Helping Relationships, items 21-24 represent Stimulus Control, items 25-28 represent Counterconditioning, items 29-32 represent Social Liberation, items 33-36 represent Self Reevaluation, and items 37-40 represent Reinforcement Management. The stems for each item are available in Appendix A.

Table 4: Standardized Processes of Change Scores

Item	N	Range	Minimum	Maximum
CR1	96	2.81	-1.58	1.23
CR2	97	2.21	- .97	1.24
CR3	96	2.28	- .98	1.29
CR4	95	2.81	-1.61	1.20
SL5	94	2.60	-1.63	.97
SL6	91	2.55	-1.51	1.05
SL7	90	2.59	-1.57	1.02
SL8	95	2.51	-1.59	.92
DR9	96	2.85	-1.68	1.17
DR10	96	2.70	-1.49	1.21
DR11	96	2.49	-1.41	1.08
DR12	93	2.74	-1.53	1.21
ER13	96	3.07	-1.65	1.41
ER14	95	2.89	-1.49	1.40
ER15	92	3.02	-1.70	1.32
ER16	94	2.78	-1.50	1.28
HR17	91	2.85	-1.65	1.20
HR18	92	3.00	-2.14	.86
HR19	89	2.61	-1.54	1.08
HR20	85	2.45	-1.34	1.12
SC21	88	2.31	- .85	1.46
SC22	87	2.55	- .86	1.68
SC23	87	2.53	- .81	1.71
SC24	85	2.62	- .86	1.75
CC25	88	3.02	-1.66	1.36
CC26	87	2.28	-1.05	1.23
CC27	86	2.53	-1.25	1.28
CC28	81	2.75	-1.55	1.20
SOC29	91	2.61	-2.00	.62
SOC30	91	2.48	-1.40	1.08
SOC31	90	2.56	-1.88	.68
SOC32	90	2.97	-2.19	.77
SR33	82	2.50	- .75	1.76
SR34	83	2.53	- .81	1.72
SR35	79	2.49	- .88	1.61
SR36	79	2.28	- .75	1.53
RM37	85	2.45	- .76	1.69
RM38	82	2.31	- .75	1.56
RM39	84	2.30	- .77	1.53
RM40	84	2.24	- .76	1.48

*Note. CR=Conscious Raising, SL=Self Liberation, DR=Dramatic Relief, ER=Environmental Reevaluation, HR=Helping Relationships, SC=Stimulus Control, CC= Counterconditioning, SOC=Social Liberation, SR=Self Reevaluation, and RM=Reinforcement Management.

For data analysis, Model 1 was selected since Roberts (2005) suggested to use the most general model. A comparison of the scale as a whole against a perfect model, given the estimated parameters demonstrated a poor fit: likelihood ratio $x^2 = (40, N = 97) = 2488.55$, $p < 0.00$. This is not surprising since the scale was not essentially intended for the unfolding framework and that results from any study are rarely perfect.

Item parameter estimates and standardized fit statistics are presented in Table 5. Boldface values indicate ill-fitting items ($p < .05$). The items are grouped according into the process of change that they belong to. The location of each of the 10 processes of change was determined by averaging each set of four items that it represented. Then the items were placed in ascending order according to the averages of each of the 10 processes of change. For a comparison with previous studies, items are clustered according to the processes they are supposed to measure according to DiClemente and Prochaska's (1985) stage of change model.

Table 5: Item Parameter Estimates and Fit Statistics

Process	Location	Standardized infit	Item x^2	*p*	Standardized outfit	Item x^2	*p*	S x^2	*p*
Reinforcement Management	- .47	- 3.65	50.94	.998	-3.18	53.63	.996	32.94	.002
	- .42	- 2.91	55.84	.990	-2.39	59.28	.977	**42.92**	**.000**
	- .37	- 3.32	51.25	.996	-2.67	54.76	.989	**34.18**	**.000**
	- .22	- 2.23	61.77	.961	-1.49	67.77	.887	**42.79**	**.000**
Social Liberation	- .43	- 1.35	76.24	.849	-.079	81.65	.723	**61.57**	**.000**
	- .38	- 3.01	60.04	.992	-1.99	68.36	.949	**36.48**	**.000**
	- .34	- 1.41	74.71	.861	-.090	79.49	.755	**53.23**	**.000**
	- .28	**4.63**	**153.05**	**.000**	**4.91**	**161.12**	**.000**	**42.65**	**.000**
Self Reevaluation	- .41	- 5.05	36.92	1.00	-4.72	37.80	1.00	27.66	.016
	- .33	- 1.68	62.30	.903	-0.92	68.91	.759	31.61	.001
	- .26	- 3.23	51.55	.996	-2.47	56.79	.981	29.99	.002
	- .18	- 2.88	55.25	.990	-2.02	61.64	.955	23.96	.013
Self Liberation	- .21	**3.45**	**135.27**	**.001**	**3.10**	**132.38**	**.002**	**34.19**	**.000**
	- .07	**3.26**	**137.07**	**.002**	**3.85**	**149.65**	**.000**	26.24	.006
	.05	1.35	106.11	.104	1.11	103.85	.134	18.30	.074
	.12	**3.54**	**144.24**	**.001**	**3.46**	**146.52**	**.000**	25.68	.007
Helping Relationships	- .34	0.78	97.52	.229	0.85	98.76	.203	11.52	.399
	- .33	**2.23**	**111.15**	**.025**	**.222**	**112.29**	**.021**	21.76	.026
	- .13	**2.71**	**126.00**	**.009**	**2.94**	**131.53**	**.004**	**36.28**	**.000**
	.02	0.92	101.53	.191	0.90	101.96	.183	19.28	.056
Stimulus Control	- .24	- 3.74	51.68	.999	-2.86	57.65	.992	24.32	.011
	- .17	- 4.63	43.51	1.00	-3.40	51.29	.998	30.36	.002
	- .16	- 3.98	49.65	.999	-2.76	58.34	.990	32.41	.001
	- .13	- 2.76	60.20	.987	-1.65	69.54	.915	28.40	.003

Table 5: Item Parameter Estimates and Fit Statistics

Process	Location	Standardized infit	Item x^2	*p*	Standardized outfit	Item x^2	*p*	S x^2	*p*
Conscious Raising	- .17	- 2.89	65.55	.991	-2.08	72.02	.962	31.51	.001
	- .12	1.37	111.52	.105	1.25	110.78	.114	15.09	.177
	- .08	- 2.00	74.68	.947	-1.23	81.84	.848	**34.48**	**.000**
	.09	**1.78**	**118.73**	**.050**	**2.19**	**126.63**	**.017**	15.75	.149
Counter-conditioning	- .11	- 1.91	67.09	.935	-1.29	72.35	.853	21.02	.033
	- .07	**2.35**	**114.19**	**.019**	**2.15**	**113.07**	**.023**	24.14	.012
	- .02	0.72	95.94	.240	1.10	101.33	.140	17.23	.100
	.11	1.34	92.63	.104	**1.75**	**102.81**	**.044**	17.00	.107
Environmental Reevaluation	.12	**2.25**	**124.38**	**.020**	**3.01**	**138.78**	**.002**	23.80	.013
	.17	1.17	108.33	.132	1.63	116.13	.053	32.91	.001
	.18	0.87	102.34	.196	**2.00**	**119.41**	**.025**	22.27	.022
	.41	- 2.52	66.39	.989	-2.13	68.76	.981	**33.62**	**.000**
Dramatic Relief	.74	- 2.33	66.42	.989	-2.35	64.48	.993	33.28	.010
	.81	- 2.59	60.87	.995	-2.46	60.60	.995	34.23	.024
	.87	- 1.64	73.68	.949	-1.74	71.18	.968	41.66	.003
	.88	- 0.90	82.79	.806	-0.89	82.28	.821	35.46	.018

Research Question #1

Table 5 presents the item parameters alongside the wording of each item. Items are clustered by the process they measure according to DiClemente and Prochaska's (1985) stage of change model. The processes are ascending mean locations (averaged over the four items). The fit statistics used here are specifically designed to answer the first research question: Can the GUM account for a relationship between the stages and processes of change?

Standardized Infit Index. According to the standardized infit index, nine of the 40 items demonstrated a poor fit, with probabilities smaller than or equal to .05. Specifically, one item from the Social Liberation subscale ("I notice that public places have sections set aside for smoking"), three items from the Self Liberation subscale ("I tell myself I can choose to smoke or not," "I make commitments not to smoke," and "I tell myself I am able to quit smoking if I want to"), two items from the Helping Relationship scale (I have someone whom I can count on when I'm having problems with my smoking," and "I can be open with at least one special person about my experience with smoking"), one item from the Conscious Raising subscale ("I recall articles dealing with the problem of quitting smoking"), one item from the Counterconditioning subscale ("When I am tempted to smoke, I think about something else", and one item from the Environmental Reevaluation subscale ("I stop to think that smoking is polluting the environment"), demonstrated poor fit.

Standardized Outfit Index. According to standardized outfit index, 11 of 40 items demonstrated poor fit, with probabilities smaller than or equal to .05. Specifically, each item that was identified as showing poor fit by the outfit index matched all the items that showed poor fit for the infit index. The two other items that demonstrated poor fit for the standardized outfit index were from Counterconditioning ("I find that doing other things with my hands is a good substitute for smoking") and Environmental Reevaulation ("I consider the view that smoking can be harmful to the environment.").

Likelihood Ratio for x^2 Item Fit Conditioned on Total Score (Sx^2). According to Sx^2, 11 of 40 items demonstrated poor fit, with probabilities smaller than .001. This level of significance is the recommended level of significance outlined by Roberts (2005).

Specifically, three items form Reinforcement Management subscale ("Other people in my daily life try to make me feel good when I don't smoke," "I am rewarded by others if I don't smoke," and "I reward myself when I don't smoke") all four items from the Social Liberation Subscale ("I see "No Smoking" signs in public buildings." "I notice that nonsmokers are asserting their rights," "I find society changing in ways that make it easier for the nonsmoker," and "I notice that public places have sections set aside for smoking"), one item from the Self Liberation subscale ("I tell myself I can choose to smoke or not"), one item from the Helping Relationships scale ("I can be open with at least one special person about my experience with smoking"), one item from the Conscious Raising subscale ("I think about information from articles and advertisements on how to stop smoking"), and one item from the Environmental Reevaluation subscale ("I am considering the belief that people quitting smoking will help to improve the world").

Summary. Standardized infit identified nine items demonstrating poor fit. Additionally, standardized outfit identified 11 items demonstrating poor fit. All items that were identified as demonstrating poor fit in standardized infit matched those identified in standardized outfit. Standardized outfit did find two additional items demonstrating poor fit. Sx^2 identified 11 items demonstrating poor fit. Additionally, the eight other items identified by Sx^2 as demonstrating poor fit that were not identified with standardized infit or outfit statistics. The three items that did demonstrated poor fit across all three fit statistics included one item from the Social Liberation subscale ("I notice that public places have sections set aside for smoking"), one item from the Self Liberation Subscale ("I tell myself I can choose to smoke or not"), and one item from the

Helping Relationships subscale ("I can be open with at least one special person about my experience with smoking").

Items' Locations and Wordings. Table 6 is a compliment to Table 5 and is organized in the exact same fashion. Beside each location are the actual items from the Processes of Change survey.

Table 6: Items' Locations and Wordings

Theoretical Process	Location	Item Wording
Reinforcement Management	- .47	I can expect to be rewarded by others if I don't smoke.
	- .42	Other people in my daily life try to make me feel good when I don't smoke.
	- .36	I am rewarded by others if I don't smoke.
	- .22	I reward myself when I don't smoke.
Social Liberation	- .43	I see "No Smoking" signs in public buildings.
	- .38	I notice that nonsmokers are asserting their rights.
	-. 34	I find society changing in ways that make it easier for the nonsmoker.
	-. 28	I notice that public places have sections set aside for smoking.
Self Reevaluation	- .41	I reassess the fact that being content with myself includes changing the smoking habit.
	-. 33	I consciously struggle with the issue that smoking contradicts my view of myself as a caring and responsible person.
	- .26	My dependency on cigarettes makes me feel disappointment in myself.
	- .18	I get upset when I think about my smoking.

Table 6: Items' Locations and Wordings continued

Theoretical Process	Location	Item Wording
Self Liberation	- .21	I tell myself I can choose to smoke or not.
	-. 08	I tell myself that if I try hard enough I can keep from smoking.
	. 05	I tell myself I am able to quit smoking if I want to.
	. 12	I make commitments not to smoke.
Helping Relationships	- .34	I have someone who listens when I need to talk about my smoking.
	- .33	I have someone whom I can count on when I'm having problems with my smoking.
	- .13	I can be open with at least one special person about my experience with smoking.
	- .02	Special people in my life accept me the same whether I smoke or not.
Stimulus Control	- .24	I keep things around my place of work that remind me not to smoke.
	- .17	I put things around my home that remind me not to smoke.
	- .16	I remove things from my place of work that remind me of smoking.
	- .13	I remove things from my home that remind me of smoking.
Conscious Raising	- .17	I recall information people had given me on how to stop smoking.
	- .12	I recall information people had personally given me on the benefits of quitting smoking.
	- .08	I think about information from articles and advertisements on how to stop smoking.
	.09	I recall articles dealing with the problem of quitting smoking.

Table 6: Items' Locations and Wordings continued

Theoretical Process	Location	Item Wording
Counterconditioning	- .11	I find that doing other things with my hands is a good substitute for smoking.
	- .07	When I am tempted to smoke, I think about something else.
	- .02	Instead of smoking, I engage in some physical activity.
	.11	I do something else instead of smoking when I need to relax or deal with tension.
Environmental Reevaluation	.12	I stop to think that smoking is polluting the environment.
	.17	I am considering the idea that the world could be a better place without my smoking.
	.18	I consider the view that smoking can be harmful to the environment.
	.41	I am considering the belief that people quitting smoking will help to improve the world.
Dramatic Relief	.74	Warnings about health hazards of smoking move me emotionally.
	.81	Remembering studies about illnesses caused by smoking upset me.
	.87	Dramatic portrayals of the evils of smoking affect me emotionally.
	.88	I react emotionally to warnings about smoking cigarettes.

Research Question #2.

The second research question that was addressed was: Can the GUM account for the curvilinear pattern in the processes of change? When dividing the ten processes of change into their respective Behavioural and Cognitive Process, six of the ten processes occur on the continuum as expected. This means that participants were using certain processes at specific stages of change and were demonstrating a curvilinear pattern. More specifically, three Behavioural Processes (Dramatic Relief, Conscious Raising, and Environmental Reevaluation) and three Cognitive Processes (Reinforcement Management, Helping Relationships, and Self Liberation) occur at or near their expected position on the continuum. The four processes that appear in different locations on the continuum are Social Liberation, Self Reevaluation, Stimulus Control, and Counterconditioning.

Table 7: Process of Change Mean Locations and the Stage of Change Model

Order	Process	Mean Location	Stage of Change
10	Reinforcement Management	- .37	
9	Social Liberation	- .35	Maintenance
8	Self Reevaluation	- .29	
7	Self Liberation	- .19	Action
6	Helping Relationships	- .19	
5	Stimulus Control	- .17	Preparation
4	Conscious Raising	- .07	
3	Counterconditioning	- .25	Contemplation
2	Environmental Reevaluation	.21	
1	Dramatic Relief	.82	Precontemplation

Table 8: Process of Change Mean Locations and the Stage of Change Model: Noel (1999)

Order	Process	Mean Location	Stage of Change
1	Dramatic Relief	-.47	Precontemplation
2	Social Liberation	-.29	
3	Conscious Raising	-.27	Contemplation
4	Environmental Reevaluation	-.09	
5	Self Reevaluation	-.04	
6	Reinforcement Management	.10	Action
7	Helping Relationships	.13	
8	Stimulus Control	.23	
9	Self Liberation	.33	Maintenance
10	Counterconditioning	.37	

Research Question #3

A comparison with previous data was conducted in order to answer the third research question: Will using the GUM and applying it to the stages and processes of change for smoking on a North American sample yield similar results as demonstrated by Noel (1999)? Comparisons between the current study and Noel (1999) study were conducted to determine if there was a relationship between the stages and processes of change across both studies. Table 7 indicates the results obtained from the current study and Table 8 displays the results obtained by Noel (1999). In order to allow for a comparison, this study followed the same procedures used by Noel (1999). A check of the data in the current study was completed by calculating mean processes of change locations for each of the 10 processes of change. These processes were then compared to the process ordering found in Noel (1999). Before the comparison, it is important to remember that Noel did not specify which numbers were assigned to each category ranges. This resulted in the reversal of categories in the current study. For example, Dramatic Relief was the most negatively scored attitude towards smoking in the study by Noel (1999), whereas in the current study it is the most positively scored attitude.

Both the current study and Noel (1999) found two items that demonstrated poor fit using the GUM. One item from the Self Liberation subscale ("I tell myself I can choose to smoke or not") and one item from the Counterconditioning subscale ("When I am tempted to smoke, I think about something else"). Since Noel (1999) stated that his sample was more representative of earlier stages of change and the current study had a sample more representative of later stages of change, perhaps these two items do not fit well using the GUM.

The results in chapter four attempted to answer three different research question. The three research questions were: 1. Can the GUM account for a relationship between the stages and processes of change?; 2. Can the GUM account for the curvilinear pattern in the processes of change?; and 3. Will using the GUM and applying it to the stages and processes of change for smoking on a North American sample yield similar results as demonstrated by Noel (1999)? The next chapter will provide an interpretation of the results as they pertain to the research questions.

Chapter 5

Discussion

This chapter presents an interpretation of the results. Included in the discussion are an explanation of the results specific to model data fit and a comparison to previous research. Finally, the importance of the research, limitations of the study, and suggestions for future research are articulated.

Sample

According to the American Cancer Society more than 80% of adults who have ever smoked cigarettes were introduced to them by the age of eighteen, and more than half were already smoking regularly by this age (American Cancer Society, 1998). In addition, Health Canada (2000) reported that 25% of Canadian teens 15-19 years old and 32% of young Canadians 20-24 years old were smokers. In the current study 251 participants were surveyed with respect to their smoking experience. A total of 97 participants (39%) indicated that they did have some type of smoking experience. Close to 50% of the participants had quit smoking, while 8.2% were actively trying to quit smoking, 24.7% were thinking about quitting, and 17.5% were not trying to quit smoking. Having only 39% of the sample indicating that they had some type of smoking experience was lower than expected based on the percentages given by the American Cancer Society (1998). Even though the percentage of smokers in the current study was low, most of the participants that had smoking experience (91%) were between the ages of 18-25. This number was expected to be quite high since most undergraduates do not attend university until they are at least 18 years of age and that the American Cancer Society (1998) and Health Canada (2000) indicated that most individuals do have some

smoking experience by this age. However, there was a low percentage of those with actual smoking experience in those originally sampled.

Model Data Fit

Research Question #1. The first research question the current study was: Can the GUM account for a relationship between the stages and processes of change? In order to answer this question, Model Data Fit statistics such as standardized infit index, standardized outfit index, and the likelihood ratio for x^2 tem fit conditioned on total score (Sx^2) were analyzed.

Standardized Infit Index. Upon examining the fit statistics, the standardized infit index found nine out of the 40 items demonstrating poor model data fit. One item from the Social Liberation subscale ("I notice that public places have sections set aside for smoking") and one of the items from the Helping Relationships subscale ("I can be open with at least one special person about my experience with smoking") both demonstrated poor fit. The reason that these items were demonstrating poor fit was that the items are a poor fit for this model since all of the fit statistics found the items demonstrating poor fit. Two other items that demonstrated poor fit were one item from the Self Liberation subscale ("I tell myself I can choose to smoke or not") and one item from the Counterconditioning subscale ("When I am tempted to smoke, I think about something else"). These are the same two items that Noel (1999) identified as demonstrating poor fit with the standardized infit index.

Out of the 10 processes of change, two more Self Liberation items ("I tell myself I can choose to smoke or not," "I make commitments not to smoke," and "I tell myself I am able to quit smoking if I want to") and one more Helping Relationships item ("I have

someone whom I can count on when I'm having problems with my smoking,") appeared to demonstrate poor fit. These items in the current study that demonstrated the worst fit are both considered behavioural processes, which are hypothesized to occur at the beginning of the Stages of Change model. In the current study the sample was found to express attitudes that are characteristic of the later stages and could be a reason why these and the other items were poorly represented.

Standardized Oufit Index. The standardized outfit index found that 11 of the 40 items demonstrated poor model data fit. Even though more items were identified using the outfit index, nine of the items were exactly the same as those that were identified by the standardized infit index. It is encouraging to have nine of the items matching with both fit statistics since they are both a different measure of how well the data fits the model. The two additional items that were identified by the standardized outfit index were from the Counterconditioning subset ("I find that doing other things with my hands is a good substitute for smoking") and the Environmental Reevaulation subset ("I consider the view that smoking can be harmful to the environment."). Perhaps a reason that these additional items were found to be ill fitting was because a majority of the sample was more characteristic of the later stages of change which could be attributed to participants using these and not other items.

Likelihood Ratio for x^2Item Fit Conditioned on Total Score ($Sx^{2)}$. The Sx^2 index also found that 11 of the 40 demonstrated poor model data fit. However, only eight of the 11 items were different than those found in the standardized infit and outfit indexes. Of these eight new items, six were found from two processes of change. Specifically, three from the Reinforcement Management subscale ("Other people in my daily life try to

make me feel good when I don't smoke," "I am rewarded by others if I don't smoke," and "I reward myself when I don't smoke") and three items from the Social Liberation subscale ("I see "No Smoking" signs in public buildings." "I notice that nonsmokers are asserting their rights," "I find society changing in ways that make it easier for the nonsmoker,") were found to be ill fitting. A reason that these items demonstrated poor fit was because these two processes were found to have to lowest alpha coefficients out of the 10 processes of change (Prochaska et al., 1988). Perhaps this is why the fourth item in Social Liberation ("I notice that public places have sections set aside for smoking") also demonstrated poor fit.

The other items that demonstrated poor fit included one item from the Self Liberation subscale ("I tell myself I can choose to smoke or not"), one item from the Helping Relationships scale ("I can be open with at least one special person about my experience with smoking"), one item from the Conscious Raising subscale ("I think about information from articles and advertisements on how to stop smoking"), and one item from the Environmental Reevaluation subscale ("I am considering the belief that people quitting smoking will help to improve the world"). Perhaps the reason that the item from Self Liberation and Helping Relationships demonstrated poor fit is because the items just do not fit. Both of these items were found to demonstrate poor fit by the standardized infit index, standardized outfit index, and Sx^2 index.

All of the statistics used to determine if the GUM could account for a relationship between the stages and processes of change indicated that there is a relationship. Taken by themselves, each of the measures indicated that the GUM could account for a relationship between the stages and processes of change. Upon further examination

standardized infit and outfit indexes indicated the highest level of agreement between the three tests. Both tests identified nine of the same items as demonstrating poor model data fit (with the outfit index identifying two additional items as ill-fitting). The Sx^2 index found that 11 of the 40 demonstrated poor model data fit. However, eight of the 11 items were different than those found in the standardized infit and outfit indexes. Although each of the fit statistics did identify that the there is a relationship between the stages and processes of change it is important to note that the distributional assumptions for all fit statistics have not been vigorously studied (Roberts, 2005) and more research using these and other fit statistics need to be completed in order to determine which statistics work best with the model.

Research Question #2. The second research question that was investigated was: Can the GUM account for the curvilinear pattern in the processes of change? When comparing the fit statistics of the current study to Noel (1999), six of the ten processes occur on the continuum as expected. More specifically, three Behavioural Processes (Dramatic Relief, Conscious Raising, and Environmental Reevaluation) and three Cognitive Processes (Reinforcement Management, Helping Relationships, and Self Liberation) occur at or near their expected position on the continuum. This means that participants were mainly using Dramatic Relief, Conscious Raising and Environmental Reevaluation early on in the stages of change. On the other hand, participants were mainly using Reinforcement Management, Helping Relationships, and Self Liberation in later stages of change. This development indicated that the processes of change occurred in a curvilinear pattern, meaning that the processes participants used during a certain

stage would occur at a higher frequency and drop as they were no longer in that stage of change.

The four processes that appear in different locations on the continuum are Social Liberation, Self Reevaluation, Stimulus Control, and Counterconditioning. The only processes of change that have all four items fit the model are Dramatic Relief and Stimulus Control. For the current study, these processes are the best represented items. Other items that occur at or near the correct location on the continuum that show strong model fit are Conscious Raising and Environmental Reevaluation. The only issue is that Stimulus Control occurs out of position on the continuum. In convergence with previous research (Noel, 1999; Prochaska et al., 1991), these items appear to be well representative of the process of change.

The other items that fall at or near the correct location on the continuum are Reinforcement Management, Helping Relationships, and Self Liberation. According to the fit statistics, there is much more ambiguity for model fit. The standardized infit and outfit statistics both indicate that all four items for Reinforcement Management demonstrate model data fit. However, when examining the same process with Sx^2, three of the items demonstrate poor fit. Additionally, Helping Relationships and Self Liberation display strong model fit for Sx^2, while the standardized infit and outfit statistics only show two items for Helping Relationships and one item for Self Liberation demonstrating model fit.

Items that do not occur at the correct location on the continuum are Self Reevaluation and Counterconditioning. Upon examining the standardized infit and outfit indexes, all four items that measure Self Reevaluation show model data fit, while Sx^2

indicates that three items have model data fit. Further, Sx^2 displayed model data fit for all four items for Counterconditioning, while standardized infit index showed one item with model data fit and standardized outfit index had two items with model data fit. From the results of the current study, perhaps Reinforcement Management, Helping Relationships, Self Liberation, Self Reevaluation, and Counterconditioning need to be further examined before ruling out or confirming model data fit using the GGUM since these processes have been found to occur at or near their location in previous research (Noel, 1996; Prochaska et al., 1992).

Finally, the one process that appears out of position on the continuum and shows the poorest fit is Social Liberation. Perhaps Social Liberation needs to be further examined in future research to determine if it is useful to the model or the processes of change theory.

Research Question #3. The third research question addressed in this study was whether or not the GUM could yield similar results as demonstrated by Noel (1999) and Prochaska et al. (1992). The results of the current study were compared to the model data fit obtained by Noel (1999) and the original theory of the Stages and Processes of Change by Prochaska et al. (1991). In the current study, six of the ten processes occur on the continuum as expected. When comparing the current study to Noel's (1999) study, three Behavioural Processes (Dramatic Relief, Conscious Raising, and Environmental Reevaluation) and three Cognitive Processes (Reinforcement Management, Helping Relationships, and Self Liberation) occur at or near their expected position on the continuum. The four processes that appear in different locations on the continuum are Social Liberation, Self Reevaluation, Stimulus Control, and Counterconditioning.

Noel's (1999) results showed that Dramatic Relief occurred first on the continuum, closely followed by Social Liberation. Both of these processes are typical of stages of change (precontemplation) in previous research (Prochaska et al., 1992). In the current study, Dramatic Relief was also the first on the continuum, replicating Noel's (1999) results. However in contrast to Noel's (1999) study, in the current study Dramatic Relief was followed by Environmental Reevaluation. Environmental Reevaluation is more characteristic of the contemplation stage of change than precontemplation. However, the current finding was in line with cross sectional research conducted by Prochaska, et al (1992). This means that the current study found Environmental Reevaluation to be more consistent with the proposed theory of the processes and stages of change conducted by Prochaska, et al (1992) than Noel (1999) was able to.

The third processes identified on the continuum in Noel's (1999) study was Conscious Raising. Noel (1999) claims that two of the Conscious Raising items ("I recall information people have personally given me on the benefits of quitting smoking," and " I recall information people have personally given me on how to stop smoking") appear close to the Dramatic Relief items because they can be considered as items tapping both Conscious Raising and external support. The fourth processes identified on the continuum by Noel (1999) was Environmental Reevaluation and it was classified as occurring in the contemplation stage, where as in the current study Environmental Evaluation was occurring between the stages of precontemplation and contemplation.

In the current study, Counterconditioning was the third process identified on the continuum. However, this item is not expected to occur until much later according to Noel (1999) and Prochaska et al., (1991) and is usually considered as part of the

maintenance stage. Thus, this process might be disordered. The fourth process identified on the continuum in the current study was Conscious Raising. According to Noel (1999) and Prochaska et al. (1991) Conscious Raising is expected to occur earlier according and it is usually considered as part of the precontemplation stage. Although slightly disordered this finding is not discouraging because Conscious Raising is generally found to occur in the early stages in the attitudes towards smoking behaviour and is still well grouped with other Cognitive Processes (Dramatic Relief, Environmental Reevaluation, Conscious Raising, Self Reevaluation, and Social Liberation).

The fifth and sixth processes that Noel (1999) found on the continuum and are classified as later stages of contemplation and earlier stages of action are Self Reevaluation and Reinforcement Management. Noel (1999) states that both items are in good convergence with the previous research. This means that Noel (1999) found Self Reevaluation and Reinforcement Management to be more consistent with the theory of the processes and stages of change conducted by Prochaska, et al (1992).

In the current study, the fifth and sixth processes on the continuum are Stimulus Control and Helping Relationships respectively. Both of these processes are expected to occur later on the continuum. A reason why Helping Relationships occurred earlier in the current study is the fact that two of the items were found to be ill-fitting. Another reason these processes could fall early on in the continuum in the current study is that a majority of the sample was more characteristic of the later stages of change. This means that a much more diverse set of attitudes could be having an effect on these processes. Although these processes do occur earlier in the current study than Noel (1999) it is not discouraging. Both Stimulus Control and Helping Relationships side by side on the

continuum in the current study and in Noel (1999).

In Noel's (1999) study, the seventh and eighth process on the continuum is Helping Relationships and Stimulus Control respectively. According to Prochaska et al. (1991) Helping Relationships can have a bimodal curve, meaning that it overlaps in the contemplation and action stage, so it is not clear what stage of change Helping Relationships belongs to. This is encouraging since the current study found that Helping Relationships occurred earlier on the continuum. This could provide evidence that Helping Relationships is robust and perhaps can occur even earlier than anticipated.

In the current study, the seventh process on the continuum are Self Liberation and respectively. Self Liberation occurs early on the current studies continuum. On the other hand, Self Liberation occurs earlier on the continuum according the original theory proposed by Prochaska et al. (1992) and later on the continuum according to Noel (1999). This could mean a couple of different things for this process. First, perhaps the items that represent Self Liberation are not well representative of the process they intend to measure. This means that there could be a problem with participant interpretation of the items. This could affect how the items are answered and why they are found in different locations on the continuum in the current study and in Noel (1999). Secondly, Self Liberation could be like Helping Relationships in the sense that it is bi-modal as it was identified by Prochaska et al. (1992). A case could be made that Self Liberation could overlap between different stages of change.

In the current study, the eighth process on the continuum was Self Reevaluation. This process occurred later on the continuum when being compared to Noel (1999). This could have occurred this late on the continuum because of the sample. The sample in the

current study was more representative of later stages of change and thus was more likely to indicate that processes are occurring in later than they have been proposed to occur.

In Noel's (1999) study, the ninth and tenth processes on the continuum were Self Liberation and Counterconditioning respectively. Although Counterconditioning does fall on the later stages of the continuum as it was found in Prochaska et al. (1992), Self Liberation occurs slightly earlier. In the current study, the ninth and tenth processes found on the continuum were Social Liberation and Reinforcement Management. Although Reinforcement Management was found to occur later on the continuum when it is compared to Noel (1999) it is much more consistent with the original theory provided by Prochaska et al. 1992) which is an encouraging result. Even though Noel (1999) did find this process to occur earlier on the continuum, when the processes get divided into Cognitive Processes and Behavioral Processes, Reinforcement Management still occurs within the proper Behavioral Process.

A reason that Social Liberation might appear so late in the continuum is that the processes of change might not be properly measuring the concept. Much has changed since DiClemente and Prochaska (1985) first introduced the processes and stages of change model. The items listed that are suggested to measure Social Liberation might be out of date, especially for a Canadian sample. For instance, two of the statements that measures Social Liberation: "I notice that society changing in ways that make it easier for the non-smoker" and "I notice that non-smokers are asserting their rights". In Canada, many cities across the provinces and territories have placed smoking bans in a variety of different venues such as the workplace, restaurants, bars, and other public places. Perhaps individuals are not simply noticing changes because these "changes" are now

laws that have been passed by the government which benefit society and the non-smoker. Additionally, consider the statement "I notice that public places have sections set aside for smokers". With all of the laws that have been passed in Canada recently, the only place a person can easily smoke is outside or in their own home.

Another issue that could have affected the results with respect to the Processes of Change items is that they are dated. All of the items related to smoking were created well over 20 years ago (DiClemente & Prochaska, 1985) and a lot has changed to the public's perception of smoking. This could be why the items that purport to measure Social Liberation are found so much later on the continuum than in previous research. Items within the subscale of Social Liberation ("I notice that society changing in ways that make it easier for the non-smoker."; "I notice that non-smokers are asserting their rights."; "I notice that public places have sections set aside for smokers."; and "I see 'No Smoking' signs in public buildings.") are outdated, especially for a Canadian sample since recent laws or by-laws across many Canadian towns and cities as well as provinces and territories have banned cigarette smoking in public places. Perhaps Social Liberation needs reworded or updated in order to reflect that changes in society and to become more culturally sensitive.

Importance of Research

There has been an abundance of research with cumulative models on the stages and processes of change and only a few studies analyzing it with an unfolding model. This is why it is vital that this type of research continue. It is important to gain further understanding of new models that have not been widely used in order to determine if they are worth applying in this and other domains. If unfolding models such as the GGUM

can produce results that cumulative models have found, it will provide further evidence that the theory or data being tested does work across models.

This study used the Noel (1999) study as a template with a sample of young Canadian adults with various smoking experience. The first research question included in this study was: Can the GUM account for a relationship between the stages and processes of change? Since it has been found that a cumulative model accounted for an interaction between the stages and processes of change and that Noel (1999) also found this interaction using an unfolding model, this study attempted to find an interaction between the stages and processes of change using the GUM. Another area that was investigated will be the actual processes in the processes of change. Noel (1999) found that individuals that belonged to certain stages of change used specific processes of change, which were represented by a curvilinear pattern. In other words, once an individual moves from one stage to another, they do not use the processes of change associated with that earlier stage any longer. Thus, the second research question that will be investigated in this study is: Can the GUM account for the curvilinear pattern in the processes of change? The third research question that was addressed in this study was: Will using the GUM and applying it to the stages and processes of change for smoking on a North American sample yield similar results as demonstrated by Noel (1999)? This study tried to replicate the results that were found by Noel (1999) using the GUM.

By measuring the relationship between the stages and processes of change with an unfolding model, it will give further support to the TTM if it can find similar results as the cumulative model used by Prochaska et al. (1991) because the model is able to fit different scales of attitude measurement. In replicating this study it will be the first time

that the unfolding model will be used based on the integration of the stages and processes of change on a North American sample which has not been done before. By being able to identify the interaction between the stages and processes of change using the unfolding model in this study it will demonstrate support for the results obtained by Noel (1999). One advantage to using an unfolding model is that it measures all the different types of attitudes that various individuals hold as opposed to the cumulative model. In measuring attitudes with a cumulative model there are specific scale positions (strongly disagree, disagree, agree, strongly agree); whereas in the unfolding model can measure attitudes that are more neutral. In addition, demonstrating the integration of the stages and processes of change can assist those who are in a position to create efficient intervention strategies for individuals at different stages of change who want help quitting smoking.

Limitations

The main limitation of this study was the sample selected. First, the sample used in this study was a sample of convenience. Only undergraduate students from various College's at the University of Saskatchewan were sampled, so the results could be only representative of the population sampled. Second, a total of 251 participants were recruited but only 97 had some current or previous type of smoking experience. Roberts and Laughlin (1996) indicated that accurate estimates of the GGUM parameters can be obtained with a sample size of 100. This study came close to meeting this requirement, but fell short by three participants. Not meeting the minimum sample size set out by Roberts and Laughlin could have affected the results obtained in this study. Finally, the sample did not yield equal numbers of participants across the Stages of Change. More participants were found to be in the later Stages of Change (action and maintenance) than

in the earlier Stages of Change (precontemplation, contemplation, and preparation). Noel's (1999) sample was more representative of the earlier Stages of Change since his sample was derived from a treatment program. It would be beneficial for future research in this area to obtain a sample that has a more equal balance of participants across the Stages of Change.

Another limitation of this study concerns the validity and reliability of the Processes of Change questionnaire. Prochaska, et al. (1988) established high internal consistency with alpha coefficients of scales ranging from .69 to .92 for each four item process. Social Liberation was one of the two (Reinforcement Management) of the processes found to have alpha coefficients less than .80 (Prochaska et al., 1988). Low internal consistency of Social Liberation could be related to the fact that the items are dated. Further, checks of validity conducted by Prochaska, et al. (1988) included Content validity and Convergent Validity. Content validity for the Process of Change questionnaire was established by having four trained judges select items from a pool and assign them to a process (Prochaska et al., 1988). Convergent validity for the Process of Change coefficients ranged from .34 to .72 for the coefficients, with most values around .60 (Prochaska et al., 1988). These results purport construct validity of the measure. Even though strong psychometric properties have been obtained on the Process of Change questionnaire, the instrument could benefit from further checks of validity and reliability. For example, Messick (1995) claims that it is not good enough to just have experts judge the relevance of the content of any instrument. Messick (1995) claims that factor analysis is a good tool for collecting construct validity evidence. Validity evidence can be assembled though a match between hypothesized and statistical factor loadings.

Hypothesized items are indicators of certain constructs are expected to show considerable loadings on the same factor. When an item loads on to another, it shows that the indicator is corrupted (Cronbach, 1971).

Future Research

Even though unfolding models have been accessible for many years, they are not used as frequently as cumulative models. This may be due to the fact that using and implementing a cumulative model is much simpler and straightforward. Also, the number of participants required by the unfolding model could limit researchers from using this design even though Roberts and Laughlin (1996) state that accurate estimates of GGUM parameters can be obtained with as few as 15 six category attitude items and a sample size of 100. However, this should not deter researchers from using this model. Further research needs to be completed with a larger sample more representative of each of the five Stages of Change using the GGUM to provide further evidence that the model can measure these attitudes. For instance, an extension of this research would be to replicate the analysis with a broader sample. Since the sample in Noel (1999) was more representative of earlier stages of change and the current study had a sample that was more representative of later stages of change it would be beneficial to have sample that can represent each of the stages of change. This could lead to more accurate item scaling. Additional future research could be conducted by using a different GGUM model. Although Roberts (2005) suggested that when selecting a model the most general model should be used. Perhaps one of the other models could fit the data better. However, the more complex the model becomes the greater the need for more participants.

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Appendix A

Process of Change Questionnaire

About Yourself

Please tell us a little about yourself.

Age (Day/Month/Year): _____

Gender: _____

University Program: _____

Please complete the following questions if you <u>currently smoke OR if you have smoked in the past</u>.

The following five statements will measure how you assess your current cigarette smoking behavior. Please carefully read all of the following statements first and after reading them, **<u>shade</u>** in the circle beside the one statement that represents your present smoking status. **Please mark only one of the five statements**.

- ○ I am currently not trying to quit smoking and not thinking about trying to quit.
- ○ I am currently not trying to quit smoking but I am thinking about trying to quit.
- ○ I have tried to quit smoking in the past year seriously and am thinking about quitting smoking in the next month.
- ○ I currently have quit smoking but have only done so within the last six months.
- ○ I currently have quit smoking and I have done so for longer than six months.

These questions look at what you have thought about or done with respect to cigarette smoking. Please carefully read all of the following statements first and after reading them, **shade** in the circle that represents your present status.

	Never				Repeatedly
1. I recall articles dealing with the problem of quitting smoking.	○	○	○	○	○
2. I think about information from articles and advertisements on how to stop smoking.	○	○	○	○	○
3. I recall information people had given me on how to stop smoking.	○	○	○	○	○
4. I recall information people had personally given me on the benefits of quitting smoking	○	○	○	○	○

	Never				Repeatedly
5. I tell myself I can choose to smoke or not.	○	○	○	○	○
6. I tell myself I am able to quit smoking if I want to.	○	○	○	○	○
7. I tell myself that if I try hard enough I can keep from smoking.	○	○	○	○	○
8. I make commitments not to smoke.	○	○	○	○	○

	Never				Repeatedly
9. Warnings about health hazards of smoking move me emotionally.	○	○	○	○	○
10. Dramatic portrayals of the evils of smoking affect me emotionally.	○	○	○	○	○
11. I react emotionally to warnings about smoking cigarettes.	○	○	○	○	○
12. Remembering studies about illnesses caused be smoking upset me.	○	○	○	○	○

	Never				Repeatedly
13. I am considering the belief that people quitting smoking will help to improve the world.	○	○	○	○	○
14. I stop to think that smoking is polluting the environment.	○	○	○	○	○
15. I consider the view that smoking can be harmful to the environment.	○	○	○	○	○
16. I am considering the idea that the world could be a better place without my smoking.	○	○	○	○	○

	Never				Repeatedly
17. Special people in my life accept me the same whether I smoke or not.	○	○	○	○	○
18. I can be open with at least one special person about my experience with smoking.	○	○	○	○	○
19. I have someone who listens when I need to talk about my smoking.	○	○	○	○	○
20. I have someone whom I can count on when I'm having problems with my smoking.	○	○	○	○	○

	Never				Repeatedly
21. I remove things from my home that remind me of smoking.	○	○	○	○	○
22. I keep things around my place of work that remind me not to smoke.	○	○	○	○	○
23. I remove things from my place of work that remind me of smoking.	○	○	○	○	○
24. I put things around my home that remind me not to smoke.	○	○	○	○	○

	Never				Repeatedly
25. Instead of smoking, I engage in some physical activity.	○	○	○	○	○
26. I find that doing other things with my hands is a good substitute for smoking.	○	○	○	○	○
27. When I am tempted to smoke, I think about something else.	○	○	○	○	○
28. I do something else instead of smoking when I need to relax or deal with tension.	○	○	○	○	○

	Never				Repeatedly
29. I see “No Smoking” signs in public buildings.	○	○	○	○	○
30. I notice that public places have sections set aside for smoking.	○	○	○	○	○
31. I find society changing in ways that make it easier for the nonsmoker.	○	○	○	○	○
32. I notice that nonsmokers are asserting their rights.	○	○	○	○	○

	Never				Repeatedly
33. My dependency on cigarettes makes me feel disappointment in myself.	○	○	○	○	○
34. I get upset when I think about my smoking.	○	○	○	○	○
35. I reassess the fact that being content with myself includes changing the smoking habit.	○	○	○	○	○
36. I consciously struggle with the issue that smoking contradicts my view of myself as a caring and responsible person.	○	○	○	○	○

	Never				Repeatedly
37. I can expect to be rewarded by others if I don't smoke.	○	○	○	○	○
38. I am rewarded by others if I don't smoke.	○	○	○	○	○
39. Other people in my daily life try to make me feel good when I don't smoke.	○	○	○	○	○
40. I reward myself when I don't smoke.	○	○	○	○	○

Appendix B

Recruitment Letter

Participant Recruitment Letter

My name is Rob Beever and I am a Master student in the College of Education. I am currently working on a research study on attitudes towards behaviour change with Dr. Laurie Hellsten as part of my thesis requirement. By doing this research study I am looking to see if participants who are in a certain stage of change match the processes of change that have been shown in previous research using a new statistical analysis called the graded unfolding model. I am recruiting participants for this study. This research will hopefully lead to a better understanding of how the stages of change match the certain processes of change in the unfolding model.

If you volunteer as a participant in this study, you will be asked to fill out a questionnaire. The session should take approximately 15 minutes of your time.

I would like to assure you that this study has been reviewed and received ethics clearance through the University of Saskatchewan Behavioral Research Ethics Board. Please feel free to contact the Ethics Office at 966-2084 if you have any questions about this study or the rights of a participant in any study. However, the final decision about participation is yours.

If you are interested in participating, please read and sign the attached consent form that is included with the questionnaire. Your participation in this project is entirely voluntary and there will be no negative consequences if you refuse to participate in it, withdraw from it, or refuse to answer certain questions. Your identity will be completely anonymous and confidential. There will be no impact on grades or class standing for non-participation. If at any time you are unable to make it or wish to withdraw from the study you can get a hold of me at 652-0764 or Dr. Hellsten at 966-7723.

Appendix C

Ethics Application

Ethics

1. Name of Researcher: Rob Beever
Supervisor: Dr. Laurie Hellsten
Department: College of Education, Educational Psychology & Special Education.

1a. Name of Student: Rob Beever
Type of Study: M.Ed.

1b. Start date of the study: May 7th, 2007.
Completion of the study: December, 2007.

2. Title of the Study: Stages and Processes of Change in Cigarette Smoking.

3. Abstract: This study examined the interaction between the stages of change and the processes of change for cigarette smoking using an unfolding model for analysis. Undergraduate students attending the University of Saskatchewan in the College of Education, the College of Arts and Science, and the College of Engineering will be recruited to participate in the study. The Stages of Change questionnaire was used to measure what stage the participants felt they were in with respect to their smoking behavior. The 40 item Process of Change Questionnaire was used to measure what processes participants felt that they used with respect to their smoking behavior. The questionnaire data will be analyzed to see if participants who are in a certain stage of change utilize the same patterns of processes of change that have been shown in previous research.

4. Funding: There are no sources of funding supporting this research

5. Expertise: None of these criteria apply, since there are no vulnerable populations, distinct cultural groups, or in cases where the research is above minimal risk, so this section may be omitted

6. Conflict of Interest: There are no potential conflicts of interest. The researcher has not had, currently has, or expects to have a relationship with the participants, such as teacher, health care provider, counselor, family member, etc. There are no financial benefits that will accrue from the research, including, but not limited to monetary incentives for recruiting the participants or for conducting the research.

7. Participants: Participants for the study will be recruited by asking professors at the University of Saskatchewan if I can access their classroom for potential participants. Approximately 7-10 professors will be approached from the Colleges of Education, Arts, and Science. The following list includes the classes that will be recruited from upon ethics approval:

Learners and Learning – Education – Prof. Denise Heppner
Intro to Sociology – Arts – Prof. Jim Barak
Intro to Criminology – Arts – Prof. Carolyn Brooks

Intro to Cultural Anthropology – Arts – Prof. Xu Wu
The Earth and How it Works – Science- Prof. Chris Holmden
Canadian History – Arts – Prof. Jason Gregory
Calculus I – Arts – Prof. Andreas Fisher
Calculus I – Arts – Prof. Leslie Walter
General Physics – Science – Prof. Brian Zulkoskey
Math for Education Students – Education – Prof. Michael Szafron

Once the professor consent has been provided, I will recruit participants from their classrooms. There will be around 300 participants recruited from the classrooms for this study. The information collected about the participants will be a questionnaire about attitudes towards behavior change. The questionnaire will take around 15 minutes to complete. Participation in the study is entirely voluntary and there are no penalties for not participating or withdrawing from the study at anytime. At no time will any participant or non-participant be asked to give or write their name on any of the documents. If students choose to participate, they will indicate by raising their hand in order for the researcher to distribute the questionnaire. If for any reason a participant chooses to withdraw from the study after indicating that they would participate, the participant can choose to spoil the survey, return it incomplete, or keep the survey and not hand it back to the researcher. After participants complete the questionnaire, they will hand in the questionnaire to the researcher.

7a.There will be no posters or advertisements for participation in this study. For the letter of invitation please see the attached Consent Form/Verbal Study Explanation.

8. Consent: Please refer to the Sample Consent Form for the satisfaction of this requirement.

9. Methods/Procedures: The data will to be collected will be a questionnaire. Please see the attached questionnaire to satisfy this requirement.

10. Storage of Data: At the conclusion of this study, the information that has been collected will be summarized and held in a secure computer file and the data sheets will be stored in a locked file cabinet in Dr. Hellsten's office. The data will be collected and saved for a minimum of 5 years.

11. Dissemination of Results: The data that has been collected will be used for the researcher's thesis requirements, and may be further disseminated in the form of academic presentations or paper(s).

12. Risks, Benefits, and Deception:

The costs/inconveniences/risks of this study include:

1. The understanding that participating requires approximately 15 minutes of your time
2. The understanding that the questionnaire will require your concentration and sustained mental effort.

3. There are no risks associated with participating in this study.

Confidentiality regarding the information provided will be assured by never including the name of any participant on any data sheets that are produced and individual answers will not be shared or presented in any way that would identify a person as the source. Presentation of data will be in the form of group averages and totals, never data from a single individual. All data will be aggregate.

There no benefits include in this study.

Deception is not involved in this study.

13. Confidentiality: Confidentiality regarding the information provided will be assured by never including the name of any participant on any data sheets that are produced and individual answers will not be shared or presented in any way that would identify a person as the source. Presentation of data will be in the form of group averages and totals, never data from a single individual. At the conclusion of this study, the information collected will be summarized in a computer file and the data sheets stored in a locked file cabinet in my supervisor's office. I will maintain anonymity and identity of the participants. In fact, their name never appears on any of the data forms. At no time will participants' name ever be associated with your data sheets.

14. Data/Transcript Release: Not applicable in this study

15. Debriefing and Feedback: Participants will be debriefed with a statement at the conclusion, please see the debriefing statement. If the participants so desire, the information about the results can be obtained from either Rob Beever (652-0764) or Dr. Hellsten (966-7723).

16. Required Signatures:

Researcher Name: Signature:

Supervisor Name: Signature:

Department Head: Signature:

Other (if necessary): Signature:

17. Required Contact Information:

Student: Rob Beever

113 Imperial St

Saskatoon, Saskatchewan

S7N 2H6

Or

Rob Beever

Department of Educational Psychology & Special Education

University of Saskatchewan
28 Campus Drive
Saskatoon, Saskatchewan S7N 0X1
Telephone: (306) 966-2651

Supervisor: Laurie Hellsten, Ph.D.
Assistant Professor
Graduate Chair
Department of Educational Psychology & Special Education
University of Saskatchewan
28 Campus Drive
Saskatoon, Saskatchewan S7N 0X1
Telephone: (306) 966-7723
Fax: (306) 966-7719

CONSENT FORM

You are being asked to participate voluntarily in a research project entitled *Stages and Processes of Change in Cigarette Smoking* that is being organized by Rob Beever, an M.Ed. student in the College of Education at the University of Saskatchewan. The aims of this study are to gain an understanding of attitudes towards behavior change.

If you agree to participate, you will be asked to complete a series of questions about your attitude towards behavior change. This will take approximately 15 minutes of your time. Your participation in this project is entirely voluntary and there will be no negative consequences if you refuse to participate in it, withdraw from it, or refuse to answer certain questions. Participants are free to answer only those questions that they are comfortable with answering.

Your anonymity will be maintained by the researcher. In fact you never have to reveal your name on any of the surveys that you will have to complete. The surveys will all be presented together and will have a number for coding purposes. At the conclusion of this study, the information collected will be summarized in a computer file and the data sheets stored in a locked file cabinet in my supervisor's office for a minimum of 5 years.

Confidentiality regarding the information that you provide will be assured by the researcher and my supervisor and your individual answers will not be shared or presented in any way that would identify you as the source.

The only costs/inconveniences/risks of participating is a few moments of your time. At the conclusion of this study, the information collected will be stored and analyzed on a computer program where only my supervisor and I will have access to the information.

The results of this study will be used for my thesis requirement in the M. Ed. program and will be presented at a later date. If you have any questions or concerns about the project itself or the methods used, you should contact Rob Beever at 652-0764 (home) or 966-2651 (office) or Dr. Hellsten at 966-7723.

The proposed research project was reviewed and approved on ethical grounds by the University of Saskatchewan Behavioral Research Ethics Board on _____, 2007. Please feel free to contact the Ethics Office at 966-2084 if you have any questions about this study or the rights of a participant in any study. When you are finished completing the survey, please return it to the researcher.

Having understood the above information and after being given an opportunity to have my questions answered, I agree to participate in this study.

Name of Participant:

Signature of Participant: Date:

Signature of Researcher: Date:

Verbal Study Explanation

Hello, my name is Rob Beever and I am a Master student in the College of Education. I am currently working on a research study on attitudes towards behaviour change with Dr. Laurie Hellsten as part of my thesis requirement. By doing this research study I am looking to see if participants who are in a certain stage of change match the processes of change that have been shown in previous research using a new statistical analysis called the graded unfolding model. I am recruiting participants for this study. This research will hopefully lead to a better understanding of how the stages of change interact with certain processes of change.

If you are interested in participating, please read and sign the attached consent form that is included with the questionnaire. Your participation in this project is entirely voluntary and there will be no negative consequences if you refuse to participate in it, withdraw from it, or refuse to answer certain questions. Your identity will be completely anonymous and confidential. There will be no impact on grades or class standing for non-participation.

Debriefing Statement

After the experiment has concluded for a participant they will be debriefed in the following manner:

Your participation in the experiment is now complete. Thank you very much for your participation. This experiment is expecting to find that depending upon which stage of change you are in; there is a process that matches it. Once all the participants have been administered the questionnaire and the analysis has been completed you can contact me at 652-0764 or Dr. Hellsten at 966-7723 for the results or any other details that you maybe interested in. Again, thanks for your patients and participation.